Operator's Guide
for
Mercury Instruments, Inc.

Mercor Mini-AT

Electronic Volume Corrector

Revision 3.00
May 2004

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Introduction:

The Mini-AT is a full featured, stand alone, electronic gas volume corrector. Its standard mounting is on rotary, turbine, and diaphragm meters that have a rotating shaft (instrument drive) output. The Mini-AT is also compatible with meters that provide high or low frequency meter pulses when the appropriate interface board is installed. The purpose of this Operators Guide is to provide the information necessary to install and use the Mini-AT.

The Mini-AT combines the size of Mercor Mini with the audit trail functions of the ECAT; hence, the name Mini-AT. A PC (desktop or laptop computer) is needed to configure and download the Mini-AT using Mini-AT Link or MasterLink32 software. Detailed information regarding the software is available through the Mini-AT Link Software Users Manual, or through the MasterLink32 help screens.

In addition to its small, sturdy case, the Mini-AT offers these and other features:
•High-performance, low power microprocessor
•Extended battery life
•Extended Audit Trail memory capacity (140+ days of hourly)
•FLASH memory (hence, no plug-in EPROMs)
•Firmware updates via serial port
•Jumper selectable Form-A or Form-C pulse output
•Jumper selectable Pulse Widths for volume pulses
•Dual serial ports (local and modem) with independent baud rate settings
•High-speed data transfers (up to 38.4 kbaud)
•On-board surge protection for serial & pulse data
•On-board connectors for a second pressure & temperature transducer
•Logging of a 2nd pressure (for monitoring pressure)
•Call-In via Alarm Pulse or AT commands

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Specifications

Input Volume

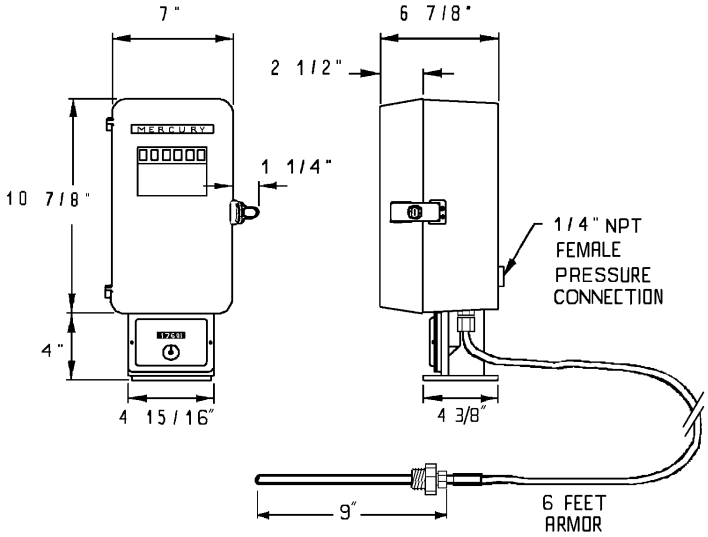
- Dual Dry-reed switches, one pulse per each meter revolution
- Uncorrected volume totalized on mechanical index, also displayable on LCD
- Input pulse counting continues with dead or removed main battery

Input Pressure

- Precision strain gauge pressure transducer compensated to minimize ambient temperature effects
- Standard Transducer Ranges:

Pressure Range		Transducer Type
PSI	BAR	
0-1	0.07	Gauge only
0-3	0.2	Gauge only
0-6	0.4	Gauge only
0-15	1.0	Gauge only
0-30	2.0	Gauge or Absolute
0-60	4.0	Gauge or Absolute
0-100	7.0	Gauge or Absolute
0-300	20	Gauge or Absolute
0-600	41	Gauge or Absolute
0-1000	70	Gauge or Absolute
0-1500	100	Gauge or Absolute

- Live display of input pressure on LCD



Input Temperature

- Highly stable, solid state temperature sensor in a sealed ¼" diameter, 9" long stainless steel probe with 6' armored conductor and ½" NPT nylon slip-along fitting to match thermowell
- Range: -40^{O}F. to 170^{O}F. (-40^{O}C. to 76.6^{O}C.)
- Live display of input temperature on LCD

Corrected Volume

- Corrected to desired Base Pressure & Base Temperature
- Corrected for Supercompressibility (NX-19 or AGA-8)
- Selectable volume units, both Metric & Imperial
- Displayed continuously on 8-digit x ½" LCD

Power

- 5.5 to 9.0 VDC
- Battery life: 3 years+ (w/ Alkaline Battery Pack)
- On-board UPS (3-AA Alkaline battery)
- Lithium, AC or Solar (Optional)
- Main battery voltage, Backup battery voltage and alarms displayable on LCD

Output Volume For data collection systems
- Jumper selectable for: one Form-C or two Form-A
- Jumper selectable pulse width (default = 62.5 msec.)
- One mechanical (Dry-reed) switch for uncorrected volume (second switch optionally available)
- SPA Board optionally available

Memory
- Audit Trail: 140+ days of hourly
- Event Log: 500+ records
- Alarm Log: 200+ records
- Flash: Resident firmware (upgradable via laptop)
- E^2PROM: Resident pressure compensation coefficients and critical calibration/ configuration item values

Accuracy
Maximum error at reference conditions including linearity, repeatability and hysteresis.
- Computation: ±0.1% of corrected vol. reading
- Pressure transducer: ±0.25% of full scale
- Temperature Sensor: ±0.5^{O}F
- Combined computation: (pressure & temperature) ±0.25% of full scale

Ambient Temperature Effects
From -40^{O}F. to 170^{O}F. (-40^{O}C. to 76.6^{O}C.)
- Computation: ±0.1% of corrected vol. per 100^{O}F.
- Pressure Transducer: ±0.3% of full scale per 100^{O}F.
- Temperature Sensor: No effect

Long Term Stability
- Computation : ±0.1% of corrected vol. per year
- Pressure Transducer: ±0.3% of full scale per year
- Temperature Sensor: ±0.2% per year

Environmental Conditions
- Ambient Temperature: -40^{O}F. to 170^{O}F. (-40^{O}C. to 76.6^{O}C.)
- Ambient Humidity: 0 to 100% noncondensing

Enclosure
- Cast aluminum alloy, surface treated, baked enamel paint
- Lexan viewing windows for; uncorrected mechanical index, corrected volume LCD
- Stainless steel door latch with padlock hasp
- Mounting plate with gasket and bolts to accommodate most meters

Certifications
- UL certified for Class I, Divisions 1 & 2, Group D
- CSA certified for Class I, Divisions 1 & 2, Groups C & D

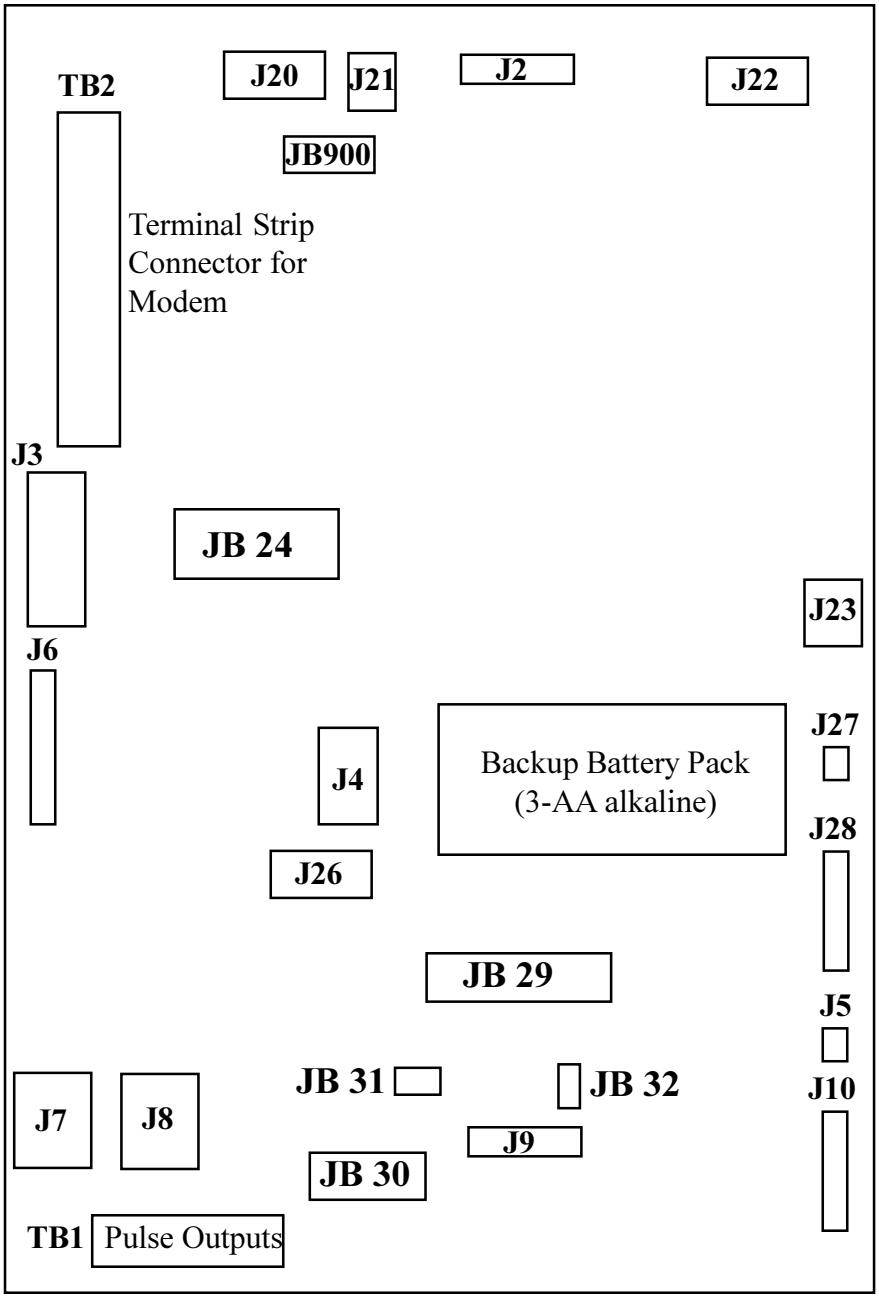


Figure 1
Diagram of the Mini-AT board,
(location of primary connections and jumpers)

Connector/Jumper	Purpose
J2	Connection for Field Calibrator
J3	Connection for LCD Display
J4	Connection for KYZ Pulse Channels
J5	Connection for Temperature-1 input
J6	Connection for local Serial Port Connector
J7	Connection #1 for Main Battery
J8	Connection #2 for Main Battery
J9	Connection for UncVol Switch Input
J10	Connection for PCor input
J20	Connection for Aux. Modem
J21	Connection for power to Aux. Modem
J22	Connection for SPI Bus
J23	Connection for BDM Port
J26	Connection for Backup Battery
J27	Connection for Temperature-2 input
J28	Connection for Plog input
JB24	Jumpers (5-position) to enable: Loader/Unconfigure/Flash Upgrade/Serial Access/ Event Log Lock
JB29	Jumpers (2-position) to select pulse width for KYa and KYb
JB30	Jumper to select Form-A or Form-C
JB31	Jumper to select Form-A or Form-C
JB32	Jumper to bypass current limit resistor for specific Pulse Input Circuits
JB900	Jumper to select Modem or Aux. Modem
TB1	Surge protected connections for Volume Pulse and Alarm Pulse Output
TB2	Surge protected connections for Modem and Alarm Pulse

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Quick Start Guide

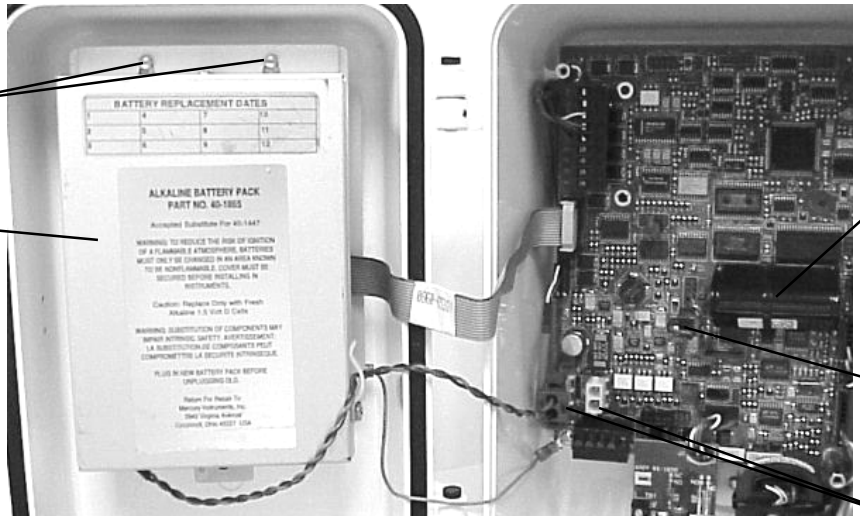
The following steps will guide you to getting the Mini-AT instrument installed and operational.

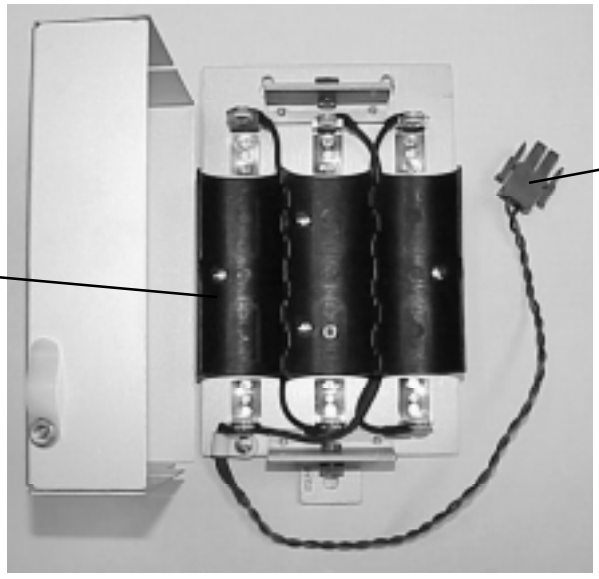
1. Carefully unpack the instrument and verify that there is no shipping damage, also verify that nothing is missing from the shipment.

2. Open the case door and make sure there are no loose connections or loose hardware.

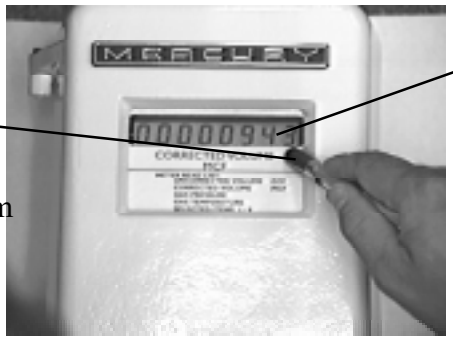
3. Install six new D-cell alkaline batteries if using the Alkaline Receptacle Pack. Plug the main battery connector into either J7 or J8. Hang the battery pack on the screws of the battery hanger plate located inside the door. Install the battery cover if using a disposable pack.

4. Plug the memory battery into J26. You may initially see the letter "P" across the LCD.

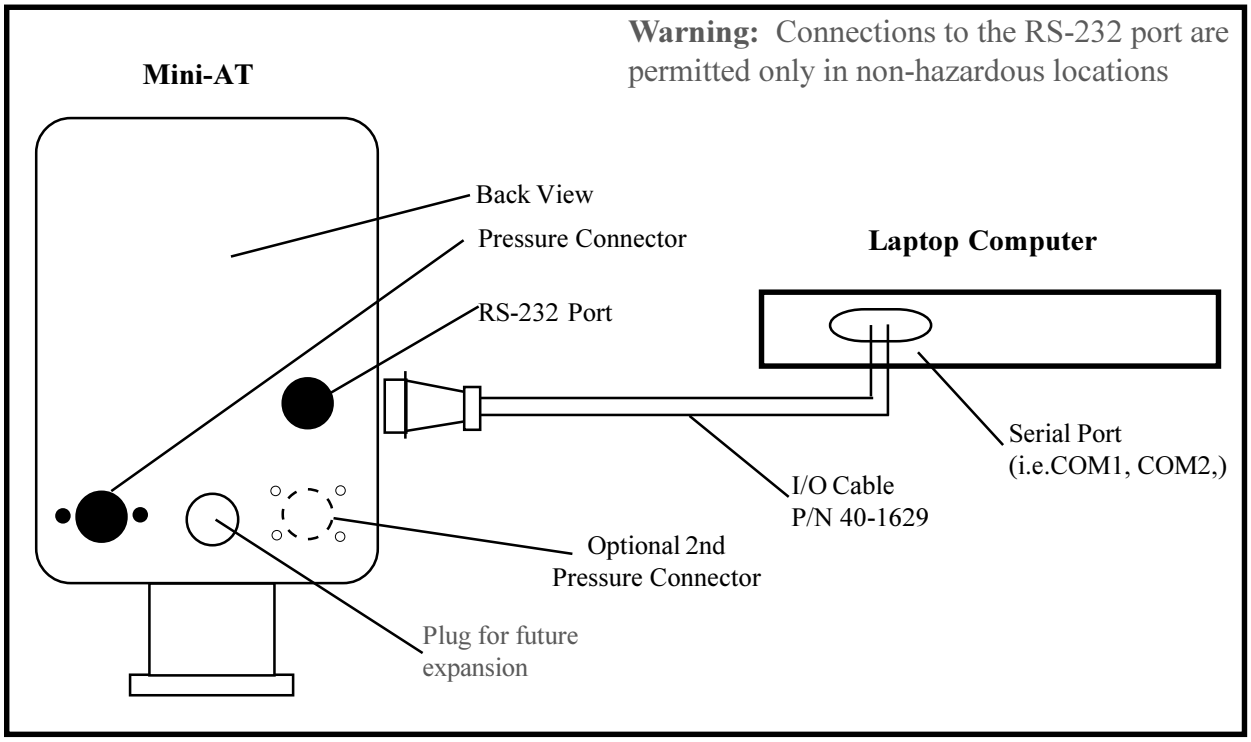




5. Verify that digits appear in the LCD display (usually all zeroes). Scroll through the meter reader list by swiping a mag wand down the right side of the display window to verify the instrument is operating.



6. Connect a standard serial cable from the Mini-AT serial connector to a computer serial port.



7. Run MasterLink32 software and use the "Set Instr. Date/Time via Computer" selection in the File Menu to set the date and time in the instrument. (Com Port and baud rate may need to be set for the Computer Serial Port. Default baud rate is 9600.)

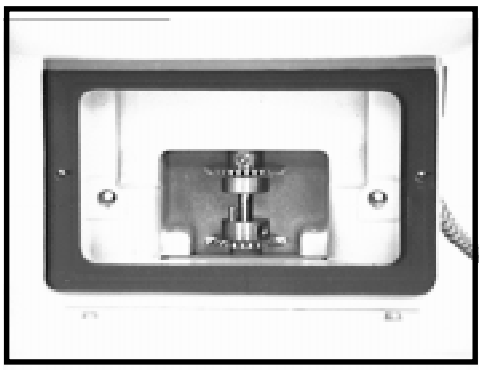
8. Use MasterLink32 to verify that company and site specific items are set properly, especially item 98 (Meter Index Code).

9. Use the "Disconnect Link" function in the Instrument menu to return the Mini-AT back to corrector mode. Remove the I/O cable from the back of the instrument.

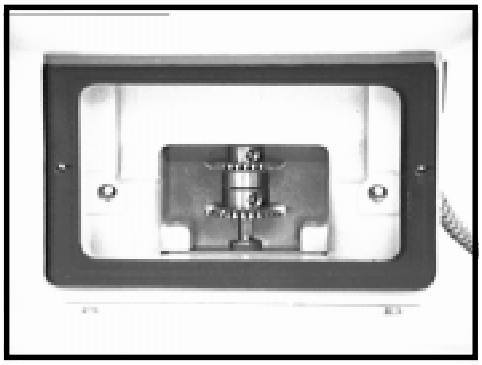
10. Position the Mini-AT on the meter, making sure that the wriggler is aligned properly. Bolt the Mini-AT to the meter using the mounting bolts and gasket provided.

11. Verify the Test Hand rotates in the clockwise direction. If not, remove the black mechanical index

assembly and shift the lower bevel gear to the proper location.

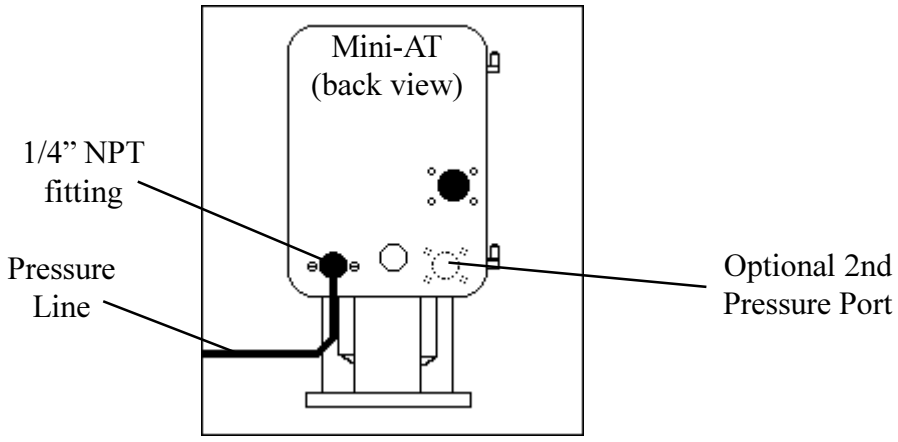


Bevel Gear DOWN for CW

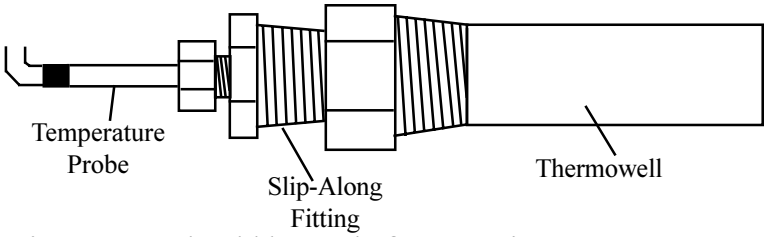


Bevel Gear UP for CCW

12. Connect the pressure line to the 1/4" NPT fitting at the back of the instrument.



13. Insert the slip-along fitting into the thermowell, and place the temperature probe into the slip-along fitting, sliding the probe down until it bottoms out in the thermowell before tightening the slip-along nut



14. At this point the instrument should be ready for operation.

Correction Factors to Metered Volume

Ideal or perfect gases follow the relationship of Boyle's Law for pressure effect and Charles' Law for temperature effect, which can be stated: The volume of any definite weight of a perfect gas varies inversely with change in absolute pressure and directly with change in absolute temperature. The equation for this relationship of the two laws is expressed as follows:

$$\frac{V1\ P1}{T1} = \frac{V2\ P2}{T2}$$

The Symbols V1, P1 and T1 refer to the original volume, pressure and temperature while V2, P2 and T2 refer to the volume, pressure and temperature of the new or changed conditions. Rearranging the equation and rewriting subscripts, we can express it as follows:

$$Vb = Vm \times \left(\frac{Pm}{Pb} \times \frac{Tb}{Tm} \right)$$

Where: Vb = gas volume (cu. ft.) at base condition corrected
Pb = absolute base pressure (psia)
Tb = absolute base temperature (deg. R)
Vm = gas volume metered (cu. ft.) uncorrected
Pm = absolute meter pressure (psia)
Tm = absolute meter temperature (deg. R)

Pressure Factor Fp

The pressure factor (Fp) to apply to metered volume is expressed by the Boyle's Law relationship as follows:

$$Fp = \frac{Pm}{Pb} = \frac{\text{Meter pressure (PSIG) + atmospheric pressure (PSIA)}}{\text{Base pressure (PSIA)}}$$

Each increment of meter pressure represents a different pressure factor. As the flowing gas pressure (Pm) changes, the Mini-AT automatically applies the pressure factor (Fp) to the metered volume (Vm).

Temperature Factor Ft

The temperature factor (Ft) to apply to metered volume is expressed by the Charles' Law relationship as follows:

$$Ft = \frac{Tb}{Tm} = \frac{\text{Base temperature, deg. F + 459.67}}{\text{Meter temperature, deg. F + 459.67}}$$

Each increment of meter temperature represents a different temperature factor. Therefore, as the flowing gas temperature (Tm) changes, the Mini-AT automatically applies the temperature factor (Ft) to the metered volume.

Supercompressibility Factor Fpv

Gases actually behave in a manner slightly different from what the ideal gas laws indicate. This deviation depends on the molecular composition of the gas and the specific gravity as well as the pressure and temperature. Natural gas, for instance, compresses by a greater amount than that computed by Boyle's Law and hence the term "supercompressibility" is used for this deviation. It is small at very low pressure, but becomes substantial as the pressure increases. The Mini-AT automatically applies the supercompressibility factor and therefore the equation for total volume correction which the Mini-AT applies to metered volume, is expressed as:

$$Vb = Vm \times Fp \times Ft \times (Fpv)^2$$

Where:
- Vb = volume corrected to base conditions
- Vm = metered volume read from the meter index
- Fp = pressure factor
- Ft = temperature factor
- Fpv = supercompressibility factor determined from AGA 3 / NX-19 or AGA 8, from the AGA Manual for Determination of Supercompressibility Factors for Natural Gas. The values of Fpv are derived in the tables for use with orifice meters, which are square root function measurements. So the flow equation for linear volume meters must square the value of Fpv.

The Mini-AT automatically squares the supercompressibility factor displayed, which is based on the pressure and temperature sensed at the meter. The resulting volume readout is corrected for pressure, temperature, and supercompressibility.

How the Mini-AT Works

The Mini-AT is a dedicated microcomputer that uses precision sensors to measure gas pressure and temperature and corrects metered volume. The electronic circuits are powered by the battery pack located in the case door. The battery voltage is regulated to the various voltages required by the remaining circuits. While in the Corrector Mode, most of the electronic circuitry is in an 'unpowered' (asleep) state. When the magnet disc rotates and actuates the input switches, the electronics are energized and begins its correction cycle. The input switches not only 'wake-up' the electronics, but are also the input for uncorrected volume. The volume that each input closure represents is defined by Item Code 098 multiplied by the scaling value at Item Code 114.

Once the instrument 'wakes-up', the computer program in firmware instructs the CPU (microprocessor) to obtain analog measurements. At least five analog signals, PCor gas pressure, gas temperature, main battery voltage, memory battery voltage and case temperature, are multiplexed through the A/D converter and sent to the microprocessor for processing.

The microprocessor converts the digitized analog signals to an equivalent numeric value and stores this information in memory. PCor Gas Pressure is stored at Item Code 008, Gas Temperature is stored at Item Code 026, Main Battery Voltage is stored at Item Code 048, Backup Battery Voltage is stored at Item Code 051 and Case Temperature is stored at Item Code 031. After all measurements are obtained, the microprocessor compares the measured values to the parameter limits already in memory, i.e., PCor pressure low limit, temperature high limit, battery low limit, etc. If any of the measured parameters are out of range, the microprocessor jumps to an alarm subroutine. Except for battery Shutdown Voltage limit exceeded, the alarm subroutine activates the appropriate alarm item code, turns on the alarm indicator and transmits an alarm pulse out the alarm channel. After the alarm sequence is complete, the microprocessor returns to its normal functions.

At the time of a full 'wake-up', if the battery Shutdown Voltage low-limit (item code 50) is exceeded, the microprocessor activates the alarm indicator (all seven LCD decimal points are turned-on), transmits an alarm pulse on the alarm channel, spells out the word "HELP" on the LCD. Under these conditions, the "HELP" message is displayed for as long as there is enough battery voltage to maintain the display. The Mini-AT is no longer correcting the gas volume, however, the mechanical index is still functional. To restore normal instrument operation, remove the dead battery and replace it with a fresh one.

After the alarm subroutine is complete, or if no alarm conditions are present, the microprocessor computes new correction factors based on the new measurements and parameters already in memory. Parameters in memory are items such as; Base Pressure, Base Temperature, Specific Gravity, etc. The new correction factors are then applied to the uncorrected volume input to obtain the corrected volume. The amount of corrected volume just calculated is then added to the totalized corrected volume stored at Item Code 000. The uncorrected volume just received is also added to the totalized uncorrected volume stored at Item Code 002.

When the microprocessor has completed the updating of its memory registers and item codes, it will update the LCD with the new corrected volume information. The microprocessor will then power down most of the main board circuits and transmits corrected volume pulses, if Item Codes 093, 094 or 095 were configured for 'pulse output'. Otherwise, the main board will go back into the 'asleep' mode waiting for the next uncorrected volume input pulse.

Three other conditions can cause the Mini-AT to 'wake-up' while in the Corrector Mode. They are; a Mag Wand Input, a Serial Communication Link or a scheduled audit trail log entry. A Mag Wand Input is caused by passing a magnetic wand across the Mag Read Switch located on the LCD Display Board. A Mag Wand Input will cause the microprocessor to initiate the Meter Reader Mode. A 'wake-up' caused by a Serial Communication Link will allow the instrument to 'talk' to serial devices connected to either of the RS-232 ports (local or modem). An audit trail wake-up occurs at regular time intervals as specified by the user, at Item Code 202. In all three cases, the microprocessor will initiate a full correction cycle as described above. Except for audit trail wake-ups, after the completion of the correction cycle, most main board circuits will remain energized while the instrument is performing the user requested tasks.

Drive Input

A universal mounting bracket, containing a standard digital index for indicating uncorrected volume, is used to mount the Mini-AT to a meter. A reversing gear mechanism permits changing the index rotation to match meter rotation (see figures 2 and 3). Input of uncorrected volume is made by magnetically operated reed switches. A magnet is located on a disc/shaft and is rotated by the meter output shaft. There is very little torque loading on the meter. The dual input switches allow continued operation if one switch should fails. Input switch #1 is located along the right edge of the Input Switch Board (S1) and switch #2 is located just to its left (S2). If a switch failure is detected, an alarm is displayed.

PCor Pressure System

The PCor pressure sensing system incorporates a precision strain gage pressure transducer, located inside the Mini-AT enclosure with a 1/4" NPT female case connection. A valve kit with shut-off valve, tubing and fittings is optionally available to make the pressure connection to the meter/pipeline. A plug-in cable is used to make the connection from the pressure transducer to the main circuit board at J10. This transducer is used for calculating the pressure correction factor, item 044.

PLog Pressure System (optional)

The optional PLog pressure sensing system incorporates a separate precision strain gage pressure transducer, also located inside the Mini-AT enclosure with a 1/4" NPT female case connection. The Plog transducer can be a different range and type than the PCor transducer. A valve kit with shut-off valve, tubing and fittings is optionally available to make the PLog pressure connection to the meter/pipeline. A plug-in cable is used to make the connection from the PLog pressure transducer to the main circuit board at J26. This transducer allows the logging of a 2nd pressure which is initiated by a time interval (not volume) set by item 401. It is usually used to monitor the upstream or downstream pressure.

Temperature System

The temperature system consists of a highly stable, solid state transducer, connected to the Mini-AT through a 6 foot length of armored conductor. The stainless steel probe is 1/4" diameter by 9 inches long and is provided with a slip-along fitting for the matching thermowell in the meter piping.

Supercompressibility Correction

Supercompressibility correction is included in the basic calculations if Item Code 110 is configured to "LIVE". Specific gravity (item 053), mol percent of N_2 (item 054) and mol percent of CO_2 (item 055) should be updated by the user so that the Mini-AT can provide accurate and continuous correction for the specified gas composition based on actual sensed pressure and temperature.

Below is a partial listing of various Mini-AT Item Codes that store correction parameters:

	Most Current	Interval Average	Daily Average	Previous Day Average
Gas Pressure	008	206	256	185
Gas Temperature	026	207	257	186
Super (Fpv)	047	187	188	189
Super $(Fpv)^2$	116	-	-	-

LCD Display and Scroll Function

A single 8 digit, 1/2" high numeric display is mounted in the door of the Mini-AT and is viewable from the outside with the door closed. The LCD (Liquid Crystal Display) normally displays the corrected volume with 4, 5, 6, 7, or 8 digits. The LCD can be configured to display any Mini-AT item. The LCD is also used to indicate alarm conditions and also to display the items configured into the Meter Reader List.

Passing a Mag Wand along the right side of the corrected volume LCD window (or pressing on the optional pushbutton) allows the user to view a pre-selected sequence of instrument readings. MasterLink software is used to select which instrument readings are to be displayed and the order in which they appear.

Computation Intervals

The Mini-AT's computation interval is referred to as a 'Full Wake-up'. During a full wake-up, power is applied to all electronic circuits so that pressure, temperature and voltage measurements may be obtained, and a new Total Correction Factor (Item Code 043) is calculated. The LCD and volume registers are also updated. The measured parameters are compared to the alarm limits and an alarm is triggered if limits are exceeded. After completion of these tasks, the circuitry will return to the 'Asleep' mode and begin transmitting corrected volume pulses if item code 093, 094 or 095 is set for pulse out. The full wake-up interval can be adjusted by changing the value (N) at Revs Per Wake-up parameter at Item Code 124. Values for N can be a number from 1 to 15, the default value is "1".

Instrument wake-up due to meter rotation other than the Nth revolution are referred to as 'Intermediate Wake-ups'. During an intermediate wake-up, gas pressure and gas temperature are not measured and the LCD is not updated. However, the last calculated correction factors are used to update the volume registers. If the Mini-AT has been configured to output volume pulses, the pulses will be transmitted at the end of each intermediate wake-up. Since the analog circuits are not active and the LCD is not updated during an intermediate wake-up, much less battery power is used as compared to an instrument with Revs Per Wake-up equal to one (N=1). Regardless of the value of "N", audit trail logging will always occur at the time interval specified at item 202.

Access Levels for Operating Personnel

There are four levels of instrument access available on the Mini-AT for operating personnel. The first level, referred to as the Corrector Mode, displays the corrected volume on the LCD and the uncorrected volume on the digital mechanical index. The Corrector Mode also provides a visual indication for instruments in an alarm condition.

The second level available is referred to as the Meter Reader Mode. Meter readers can use a magnetic wand to scroll the values of specific items on the LCD. Uncorrected and corrected volumes, a limited number of pre-specified values, such as; gas pressure gas temperature, battery voltage, and any alarms that may be activated, can be part of the meter reader list. The meter reader cannot make any changes that will effect the configuration of the Mini-AT.

The third level of access available is called: Level 1 Access Mode. This level of access requires an IBM compatible computer, MasterLink32 or Mini-AT Link software, an interface cable and the Level 1 Access Code. After the computer is connected and Level 1 Access has been gained, the operator can perform field calibration checks and make adjustments if necessary. Additionally, clearing alarms, performing certain diagnostic functions and changing the configuration of authorized items are possible. To insure data integrity, the serial communications protocol incorporates data error checking.

Access at the fourth level is reserved for the instrument technician and is referred to as Level 2 Access Mode. Access to this level requires an IBM compatible computer, Mini-AT Link software, an interface cable and the Level 2 Access Code. After the computer is connected and Level 2 Access is gained, the instrument technician can reconfigure Mini-AT parameters. Any and all item code values may be changed, including Level 1, Level 2 and the Instrument Access Codes. The Authorization Table may also be modified, which will control what item values may be changed during Level 1 Access. To insure data integrity, the serial communications protocol incorporates data error checking.

Note: Level 1 and Level 2 Access are computer software functions only. Even after gaining Level 1 or Level 2 Access, changes to the instrument's configuration are not possible until a valid Instrument Access Code is entered. After a serial link is obtained, Audit Trail, Event Log and Alarm Log downloads are also possible.

The Mini-AT continues to recognize meter input pulses while in the Meter Read, Level-1, and Level-2 Modes. Upon exiting any serial link access, the Mini-AT will perform a Full Wake-up just before returning to the Corrector Mode. Following a meter reader access, the instrument will return to the Corrector Mode;

a) without a wake-up, if there were no meter rotations during the meter reader access.
b) after an intermediate wake-up with any number of meter rotations and N greater than one.
c) after a full wake-up with any number of meter rotations and N equal to one.

Receiving the Mini-AT

When the instrument is delivered, be sure that all parts are received in good condition. Check the packing list to make certain the shipment is complete. Report any shortage or shipping damages to your Mercury Representative. Immediately file any damage claims with the carrier who delivered the shipment.

Function Check

Open the case door and check for any loose parts and verify that all connectors are properly seated. The main battery pack is packaged separately and must be installed on the inside of the case door. Mount the main battery pack and plug in the battery cable connector at either J7 or J8. The memory back-up battery should already be mounted near the center right-side of the main board (see figure 9 on page 28). Plug in the memory battery cable connector at J26. At this time, the Mini-AT should be displaying digits on the LCD (probably all zeros) and the unit is ready for functional checks.

Note: All of the function checks assumes that the instrument is configured with default parameters. The default configuration has assigned a commonly-used Meter Reader List, Pressure, Temperature and Volume Units, Alarm Limits, etc. If the Meter Reader List or instrument configuration is something other than the default, most checks can still be performed, but the results may vary slightly.

Pressure Function Check - Gauge Pressure Transducer

Use a mag wand to scroll through the Meter Reader List and stop at the live pressure display. With no pressure connected, the LCD will display a value very close to zero, typically within plus or minus 0.2% of full scale. To check the pressure measuring system, apply some amount of pressure (but less than the full range of the transducer) and observe as the LCD value increases. There is a 10 minute time-out before the instrument automatically reverts back to the Corrector Mode. Use the mag wand and scroll through the remaining items until the instrument returns to the Corrector Mode.

Pressure Function Check - Absolute Pressure Transducer

Use a mag wand to scroll through the Meter Reader List and stop at the live pressure display. With no pressure connected, the LCD will display a value very close to the local atmospheric pressure - typically within plus or minus 0.2% of full scale. To check the pressure measuring system, apply some amount of pressure (but less than the full range of the transducer) and observe as the LCD value increases. There is a 10 minute time-out before the instrument automatically reverts back to the Corrector Mode. Use the mag wand and scroll through the remaining items until the instrument returns to the Corrector Mode.

Temperature Function

Use a mag wand to scroll through the Meter Reader List and stop at the live temperature display. The LCD will display a value very close to ambient temperature - typically within plus or minus 0.5 degrees F. To check the temperature measuring system, grab the temperature probe near its tip and observe as the LCD value increase. There is a 10 minute time-out before the instrument automatically reverts back to the Corrector Mode. Use the mag wand and scroll through the remaining items until the instrument returns to the Corrector Mode.

Volume Function Check

While in the Corrector Mode, note the corrected volume reading on the LCD. Rotate the index input wriggler in one direction for ten (10) revolutions. Verify that the volume has increased by an expected amount. With zero applied pressure and at room temperature, the additional corrected volume should be essentially equal to the meter index rate, times the number of turns (10) of the wriggler. Note: the scaling of corrected volume (item 090) may make it necessary to apply more than ten revolution to see an increase at the LCD.

Standard Instrument Mounting

The Universal Mounting Bracket (UMB) permits installation of the Mini-AT on American, Rockwell, Romet, Roots or Schlumberger meters that have an instrument drive. The UMB housing may be rotated about the base plate so that the instrument and index will face in any of four (4) directions, by removing all four (4) screws which attach the base plate to the bracket housing. Replace them after you have repositioned the UMB housing.

Refer to Figure 2 and the following procedure when installing the Mini-AT on a meter.

1) Position the universal mounting bracket (UMB) and gasket on the meter mounting plate. Install the four (4) mounting bolts and tighten.
2) Connect the pressure tubing to the 1/4" NPTF case pressure connector on the rear of the instrument case.
3) Install the temperature probe slip-along fitting into the thermowell.
4) Insert the temperature probe into the slip-along fitting and tighten.

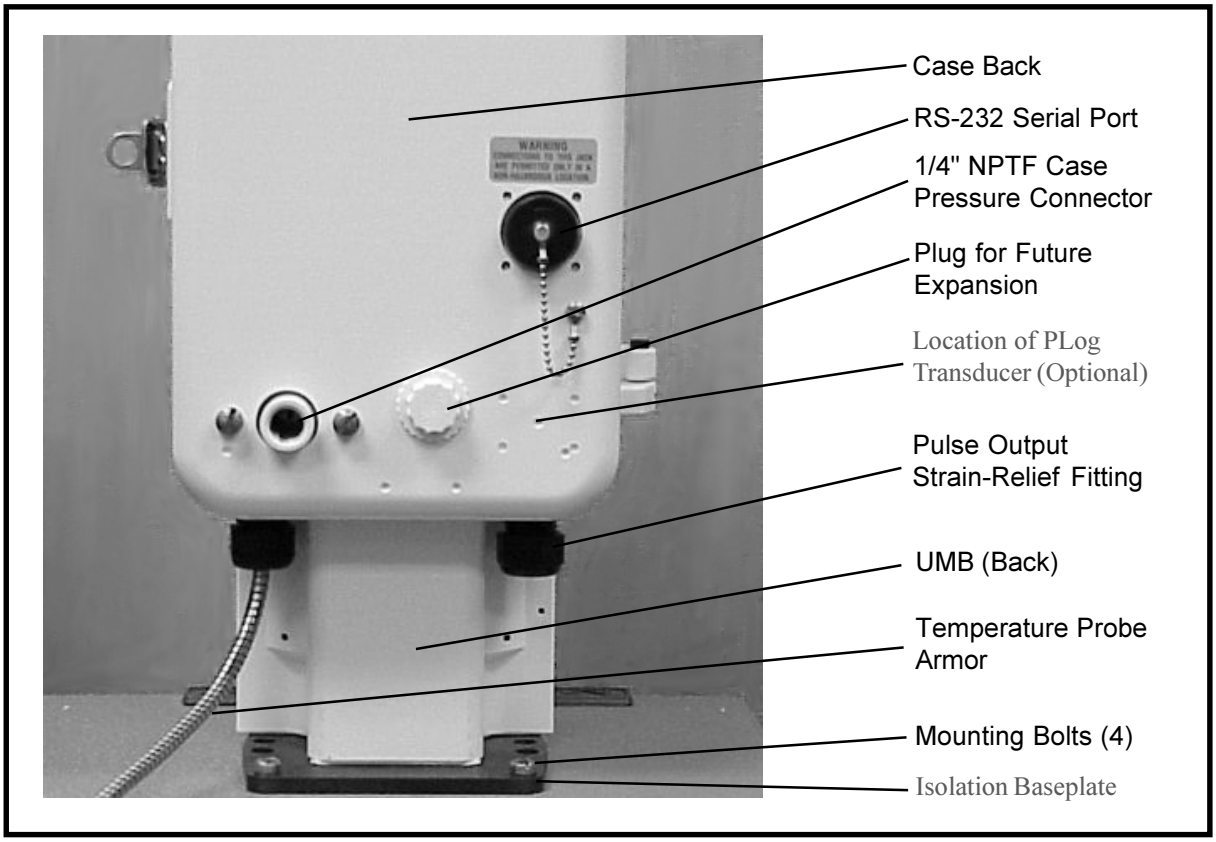


Figure 2
Back of a Mini-AT

Meter Rotation

A reversing gear in the Universal Mounting Bracket (UMB) permits either clockwise (CW) or counterclockwise (CCW) meter rotation to drive the Mini-AT. Before installing the Mini-AT, note whether the meter's drive rotation is CW or CCW. The Mini-AT should be configured to match the meter rotation. In order to check the instrument rotation:

- Remove the two slotted-screws holding the transparent index cover
- Remove the two (2) black thumbscrews and lift out the index. Compare the bevel gear placement with figures 3 and 4 to determine if the instrument is setup to work with a CW or CCW instrument drive.

To Change Rotation, if necessary:

- Use the supplied spline wrench to loosen the setscrew in the ***lower*** bevel gear. (The spline wrench can be found inside the Mini-AT near the door latch.)
- Shift the gear down against the cross bar (CW) or up against the upper gear (CCW) in order to achieve the proper gear setting. When shifting the lower gear upward, the alignment pin in the lower gear must engage the mating hole in the upper gear.
- Tighten the set screw in the lower gear
- Replace the index and thumbscrews. Ensure the bevel gears mesh properly with the face gear.
- Replace the transparent index cover and screws.

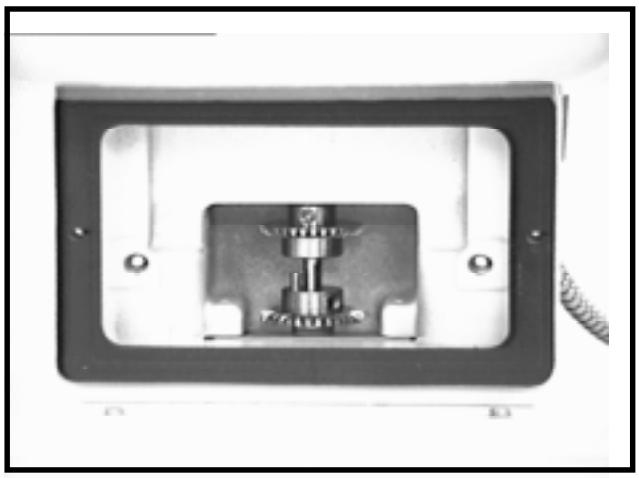


Figure 3
Bevel Gear DOWN for CW

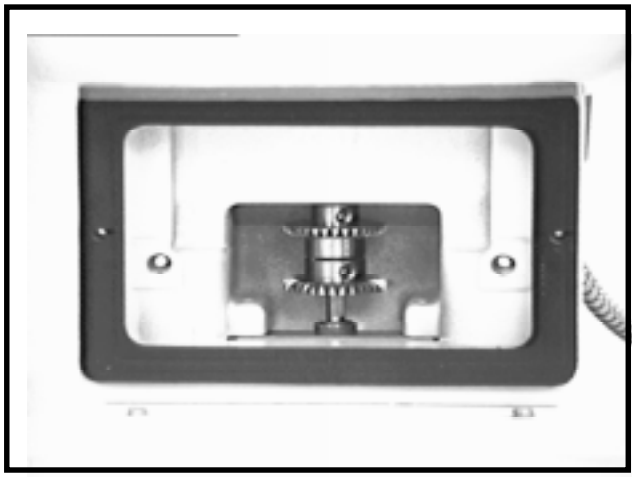


Figure 4
Bevel Gear UP for CCW

Installing a Mini-AT without an Instrument Drive

The Mini-AT can be configured to accept low frequency meter input pulses directly from a meter or Model 210/212 pulse transmitters (or any other low frequency pulse source) if a RSI board is installed. Alternatively, the Mini-AT can be configured to accept high frequency pulses from turbine meters input, but requires the High Frequency Input Board (HFI Board) instead of the RSI board (see Figure 6).

1) Low Frequency Meter Pulse Input

The Remote Switch Interface Board (RSI board, p/n 40-2016), must be installed if the Mini-AT is to receive input pulses from a Model 210/Model 212 Pulse Transmitter or a low frequency pulse from a gas meter. Figure 5 (below) and Table 1 (on the next page) provide wiring information for the RSI and Pulse Transmitters.

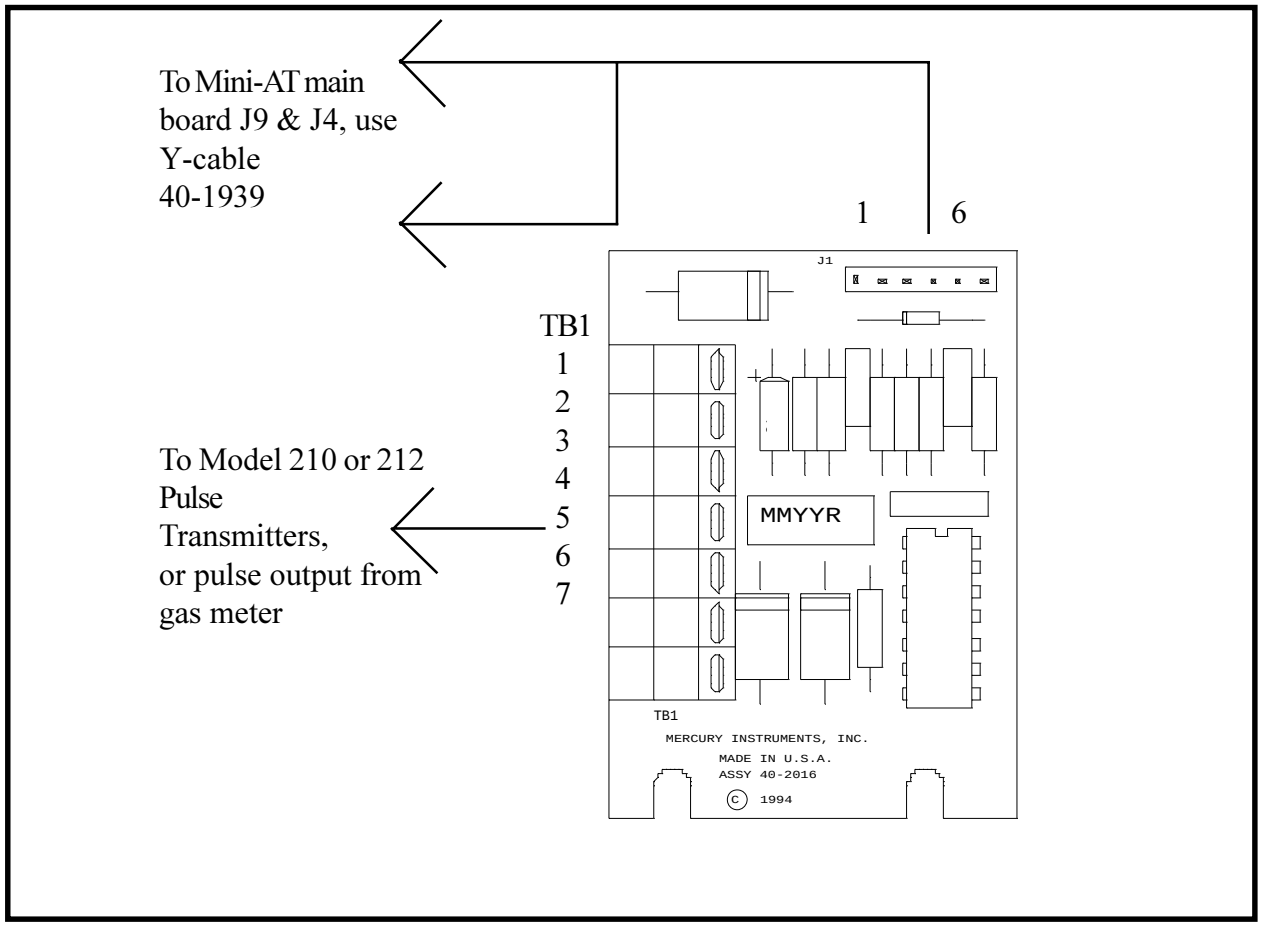


Figure 5
RSI Board
(Continued on the next page)

Form A		
Terminal	Single Switch	Dual Switch
TB1-1	SW1-NO	SW1-NO
TB1-2	N/C	N/C
TB1-3	SW1-COM	SW1-COM
TB1-4	TB1-1	SW2-NO
TB1-5	N/C	N/C
TB1-6	N/C	SW2-COM
TB1-7	Cable Shield	Cable Shield
Form C		
Terminal	Single Switch	Dual Switch
TB1-1	SW1-NO	SW1-NO
TB1-2	SW1-NC	SW1-NC
TB1-3	SW1-COM	SW1-COM
TB1-4	TB1-1	SW2-NO
TB1-5	TB1-2	SW2-NC
TB1-6	TB1-3	SW2-COM
TB1-7	Cable Shield	Cable Shield

Table 1
Wiring Connections for RSI Board

Note: NO = Normally Open
NC = Normally Closed
N/C = No Connection
COM = Commmon
SW1 = Switch # 1
SW2 = Switch # 2
TB1 = Terminal Block #1 on RSI Board

2) High Frequency Input Board

The High Frequency Input Board (HFI board, p/n 40-1913), must be installed when attempting to receive pulses from a high frequency meter. Companion software and interface cable are available for configuring and testing the HFIB. Refer to Table 2 (below) for information on selecting the proper jumpers and Table 3 (next page) for wiring connections when installing the HFI board. For more information on the HFIB and its associated software, please refer to the High Frequency Input Board Users Guide.

Note: Two different board configurations are available and are factory-configured. The HFIB is configured to meet one of two groupings of gas turbine meters:

1" - 3" Daniel Mini-Gas: This board has a "-1" label on it.
4" - 12" Daniel GTM: This board has a "-2" label on it

GTM Selection:	Board Type	Jumpers
1"-3" Mini-Gas	1	÷30K & ÷N
4"-12" GTM	2	÷2K & ÷N

Table 2
HFI Jumper Selections

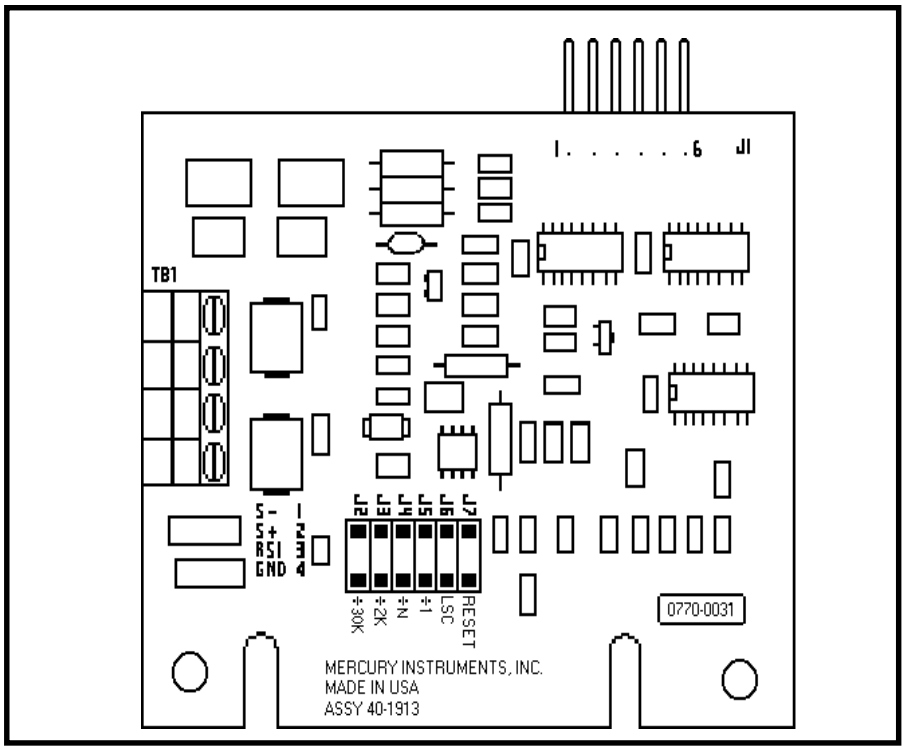


Figure 6
HFI Board

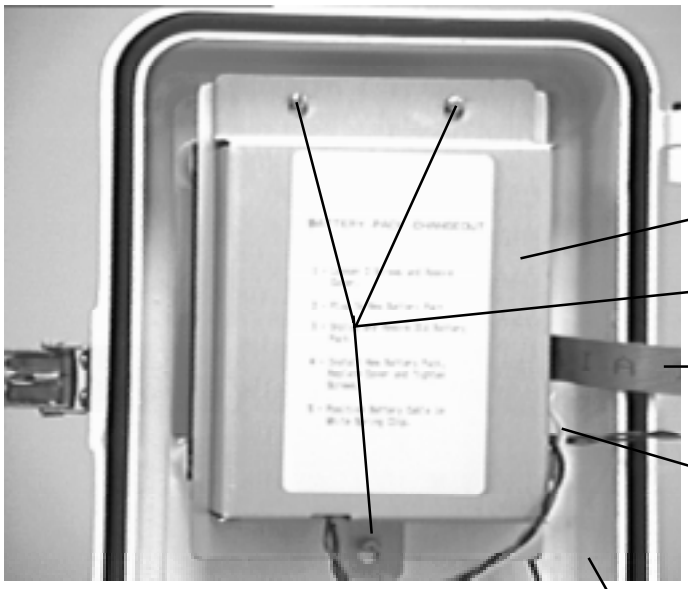
TB1 on the HFI board is used to connect the turbine meter coil wires. The wires must be connected as indicated in Table 3 below:

TB1 Label:	TB1 Position:	Funtional Description:
S-	1	Low-level input signal, low side Either coil wire can be connected, no polarity
S+	2	Low-level input signal, high side Either coil wire can be connected, no polarity
RSI	3	Not required for GTM applications at this time
GND	4	Not required for GTM applications at this time

Table 3
HFI Wiring Connections

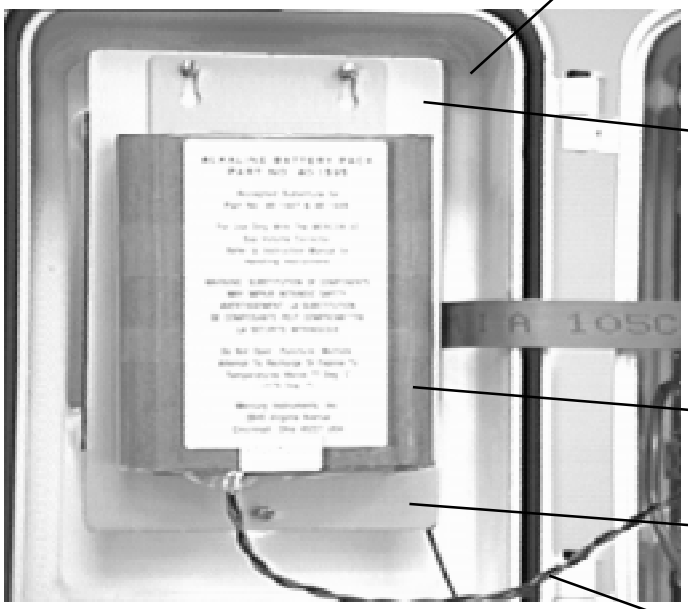
High Frequency Input Software - Meter Scaling
Version 1 (HFIB)
This software is used to calculate Meter Scaling (Item # 114) when using an HFIB in conjunction with a turbine flow meter. The Meter Scaling calculation is based upon answers to a few simple questions prompted by the program.

High Frequency Input Software - Pulse Generator
Version 1 (HFIBTEST)
This software is used to test the scaling accuracy of the HFIB by sending a specific number of pulses to the HFIB. If properly configured, the Corrected Volume displayed on the LCD will increment by a value of 1 at the end of the test. When prompted, the user provides the specific number of pulses to be transmitted out the printer port through a special adapter cable.



Inside Case Door
Figure 7

Case Door



Inside Case Door
Figure 8

Installing or Changing Battery Packs

The standard power supply for the Mini-AT is an alkaline receptacle pack (40-1865) for six replaceable D-cell batteries (batteries not included). The battery pack is mounted inside of the instrument's case door (see figure 6). The expected service life of the battery pack is greater than three (3) years under normal use, with considerable reserve to allow for battery replacement after the low battery alarm occurs. If the battery voltage drops below a preset value, a BATTERY LOW alarm occurs. When this alarm occurs, the batteries (or battery pack) should be replaced.

Several optional power supplies are available for the Mini-AT, including: lithium power pack (40-1447), disposable alkaline battery pack (40-1595), a line operated, 120vAC to 9vDC power supply (40-1775) or Solar Power.

Two main board, battery connections (J7 & J8) allow for changing the battery packs without removing electrical power from the unit. As with any computer, IT IS IMPORTANT **NOT** TO DISCONNECT POWER WHILE THE UNIT IS OPERATING, perform a SHUTDOWN first.

To install batteries in Alkaline Receptacle Pack

- After placing the instrument in Shutdown (or plugging a second battery pack into J7 or J8), loosen the three screws that secure the Alkaline Receptacle pack to the inside of instrument's door, item A in figure 7 on page 27.
- Unplug the battery cable from the main board (see figure 8 on page 27 & 1 on page 8). Remove the battery pack assembly from the instrument by sliding the pack up and off the door.
- Loosen the two slotted screws at both ends of the battery pack.
- After disengaging both clips, remove the aluminum cover from the battery assembly.
- Replace or install 6, D-cell alkaline batteries, making sure to orient each cell for proper polarity.
- Reinstall the aluminum cover and tighten the two slotted screws. Hang the battery assembly and tighten the three screws.

Warning: To reduce the risk of ignition of a flammable atmosphere, batteries must only be changed in an area known to be nonflammable. Cover must be secured before installing in instruments.

Install or replace disposable battery pack

Refer to figures 7 and 8 while following the procedure below:

- Loosen the three (3) slotted screws (item A) and remove the aluminum battery cover (item B), see figure 6.
- Plug in the new battery cable at the main board connector J7 or J8 (see figure 1).
- If present, unplug and remove the old battery pack (item C).
- Install the new battery pack by hanging the plate on the top two (2) hanger screws (item A). Replace the aluminum cover and tighten all three (3) slotted screws (item A).
- Position the battery cable in the white plastic spring clip (item D).

Backup Battery

The Mini-AT's backup battery is a triple AA-alkaline battery pack (40-2444) that plugs into the main board at connector J26 (see Figure 1 on page 8). In the event of a main power supply failure, the backup battery will maintain audit trail information.

The Mini-AT was setup according to your company's specifications and was shipped from the factory without any batteries connected. The configuration information was programmed into E^2PROM, which can maintain its memory without any power applied to the instrument. However, power must be applied to the instrument before being placed into service.

To power the Mini-AT:

1) Plug the main battery cable into either J7 or J8, the white connectors on the lower left side of the main board. **See figures 10 and 11 on page 33 for power connections when an internal modem is installed.**

2) Plug the backup battery in to jumper J26, located to the left of the backup battery pack. The backup battery pack is located near the center of the main board. The connector is keyed to ensure that it can only be installed correctly.
   It is important to plug in the main battery (or alternative power source) before plugging in the backup battery. If the batteries are plugged in incorrectly, the LCD will display '. .H.E.L.P. .' (see page 36 for more info on HELP mode). If this occurs, unplug both batteries, and wait until the LCD goes blank. At this point plug in the main battery, then the backup battery.

The Mini-AT is now fully powered. A low voltage battery alarm will occur when either the main battery or the backup battery runs low on power.

Serial Connector

The Mini-AT's serial connector permits data transfer to or from the instrument's on-board memory. Any RS-232 serial device can be connected to the instrument's serial port, but the serial device must be able to communicate using Mercury's serial data protocol.

Modem operation, as well as local serial connections, are supported by MasterLink32 and Mini-AT Link software. All other third-party software and RS-232 devices (such as Automatic Meter Reader equipment) require Mercury Serial Data Protocol to be incorporated into the communication drivers.

Refer to figure 9 below when making connections to the local RS-232 serial port. The I/O cable (p/n 40-1629) incorporates alignment tabs and a locking ring. Align the widest tab to the top and push connector into the port as far as it will go. Turn the outer locking ring clockwise to lock the cable in place. Locate the serial port on the laptop computer, it may be labeled COM1, COM2, RS-232 or just Serial. Connect the I/O cable DB-9 connector to the laptop computer serial port. The MasterLink 32 and Mini-AT Link Software Help Screens contain information about operating MasterLink32 and Mini-AT Link software.

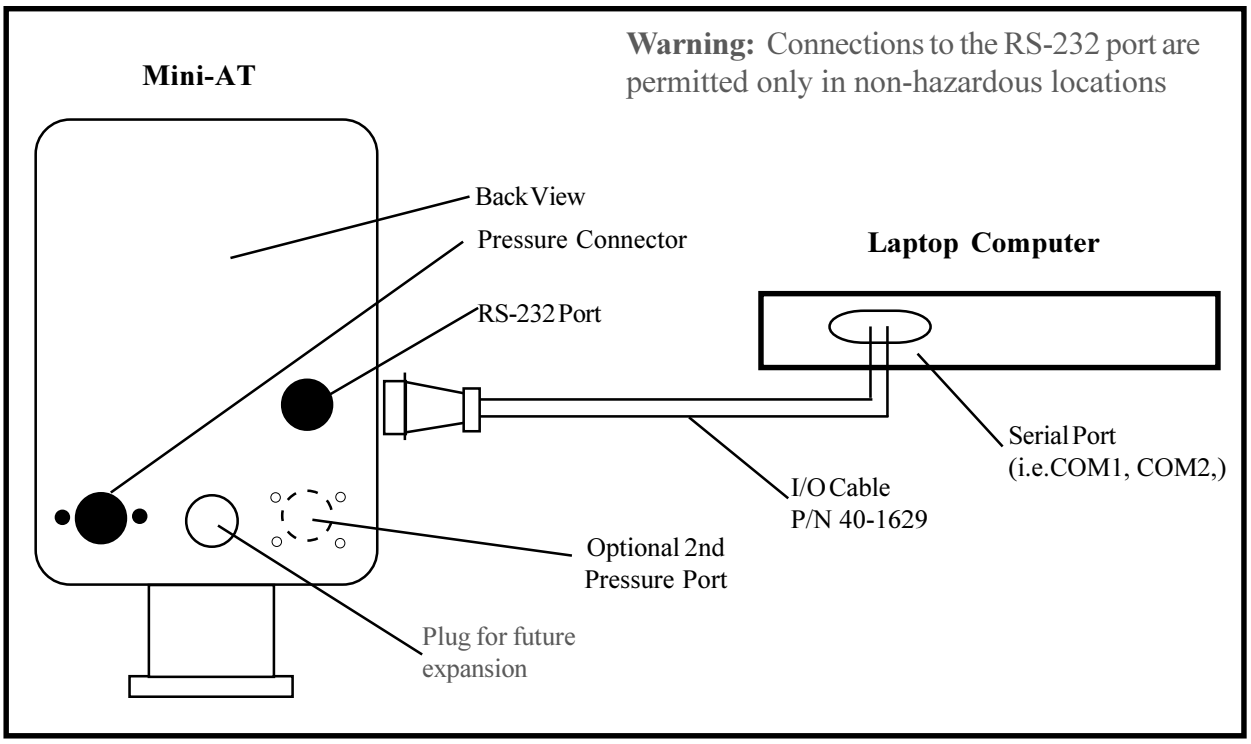


Fig. 9
Serial Connection to Mini-AT

LCD Diagnostic Function (Linking)

Beginning with firmware version 6.5121, the Mini-AT will display additional characters on the LCD to let the user know the status of the serial link. Examples are below.

Display	Description
vvvvvvv	Normal numeric display when not linked (default is corrected volume total)
LLLLLLLL	Instrument has awakened due to serial activity.
Lbbb_005	Instrument is attempting to link. 'bbb' is the Mini-AT baud rate setting at item 126. (Useful for matching instrument and computer baud rates.) '005' indicates protocol character 'ENQ' received when the baud rates of the Mini-AT and computer match.
LLvvvvvv	Instrument is linked, 'vvvvvv' is the last six digits of normal display

Communicating to the Mini-AT with a Modem

The Mini-AT has two serial ports. Typically, serial connection J6 will be used for local connections and TB2 will be used for modem connections. The serial ports are mutually exclusive, meaning only one can be used at any given time. However, the baud rates can be independently selected for each port. Use Item Code 126 to set the baud rate for the local port and Item Code 272 to set the baud rate for the modem port.

The Mini-AT is shipped with a jumper across two pins of JB900 (located in the top, central portion of the main board). The jumper must be on pins 2 and 3 to enable modem communications through terminal strip TB2 (see Table 4). **See figures 10 and 11 on page 33 for power and RS-232 connections when an internal modem is installed.**

Automatic Call-In Feature

The Mini-AT has the capability to initiate a modem to modem telephone call. This can happen under two circumstances. The first of these is an Alarm Call-In, and the second is a Scheduled Call-In.

The Alarm Call-in feature can be configured to call in one of two ways. The first is by using an alarm pulse to trigger the automatic call-in feature of a Mercury Modem. When an alarm condition is detected, the Mini-AT will generate an alarm pulse. The Alarm Call-In feature is designed to be used with Mercury Instruments Alarm-Link Software.

To use this method, set the following items:

333	Call-in Trigger	**1 -** Alarm Call-in only
486	Modem AT Enable	**0** - Call-in via Alarm Pulse

Note: The Mercury Modem has to be configured properly to use this method. Refer to the Installation Guide for the Mercury Modem for more information.

The second Alarm Call-In method is accomplished by sending Hayes AT-type commands out the serial port to a generic-type modem, such as the Messenger Modem. In this method, the Mini-AT firmware takes control of all call-related functions including call retry. During an alarm call in in this method, the LCD displays "LEvvvvvv" to let the user know that a call-in is being attempted.

To use this method, set the following items:

333	Call-in Trigger	**1 -** Alarm Call-in Only
486	Modem AT Enable	**1 -** Call-in via AT commands
491	Modem Init String	Initialization command of the modem **Default** = &F
492	Modem Dial String	Command sent to initiate dialing **Default** = ATDT
493	Alarm Call-In Phone #	Phone number to call for alarm
494	Modem Hang-up String	Command sent to modem for hang-up **Default** = ATH
495	Modem Retry Interval A	Time to wait for a retry if first call fails **Default** = 5 (value is in minutes)
496	Modem Retry Interval B	Time to wait for a retry if all calls fail **Default** = 1440 (value is in minutes)

The Scheduled Call-In feature also requires the Mini-AT to issue AT commands to a Messenger Modem. This feature is designed to interface with third party software applications that can accept a scheduled call-in from a remote site.

To use this method, set the following items:

333	Call-in Trigger	**2** - Scheduled Call-in only
334	Scheduled Call-in date	desired date of call
335	Scheduled Call-in time	desired time of call
339	Scheduled Call-In Phone#	Phone number to call at scheduled time
486	Modem AT Enable	**1** - Call-in via AT commands
491	Modem Init String	Initialization command of the modem **Default** = &F
492	Modem Dial String	Command sent to initiate dialing **Default** = ATDT
494	Modem Hang-up String	Command sent to modem for hang-up **Default** = ATH
495	Modem Retry Interval A	Time to wait for a retry if first call fails **Default** = 5 (value is in minutes)
496	Modem Retry Interval B	Time to wait for a retry if all calls fail **Default** = 1440 (value is in minutes)

Note: After each Scheduled Call-in, the date in item 334 must be changed to reflect the next desired call-in date. Otherwise the instrument will not call-in again.

The Mini-AT can also be configured to call-in for both the scheduled and alarm case. In order to configure the instrument for this method the following items must be set:

333	Call-In Trigger	**3** - Alarm & Scheduled Call-in
334	Scheduled Call-in date	desired date of call
335	Scheduled Call-in time	desired time of call
339	Scheduled Call-In Phone#	Phone number to call at scheduled time
486	Modem AT Enable	**1** - Call-in via AT commands
491	Modem Init String	Initialization command of the modem **Default** = &F
492	Modem Dial String	Command sent to initiate dialing **Default** = ATDT
493	Alarm Call-In Phone #	Phone number to call for alarm
494	Modem Hang-up String	Command sent to modem for hang-up **Default** = ATH
495	Modem Retry Interval A	Time to wait for a retry if first call fails **Default** = 5 (value is in minutes)
496	Modem Retry Interval B	Time to wait for a retry if all calls fail **Default** = 1440 (value is in minutes)

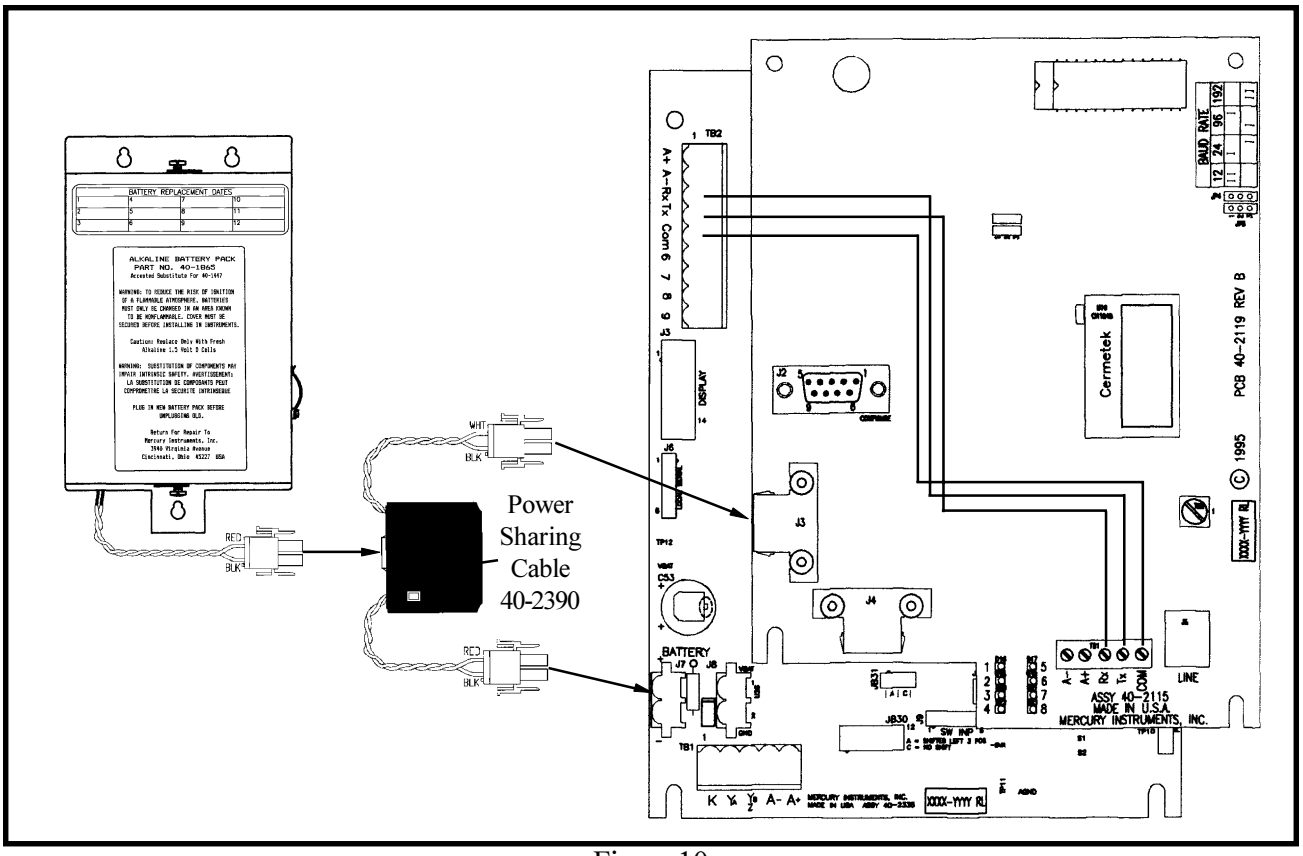


Figure 10
Mini-AT to MI Modem Connections

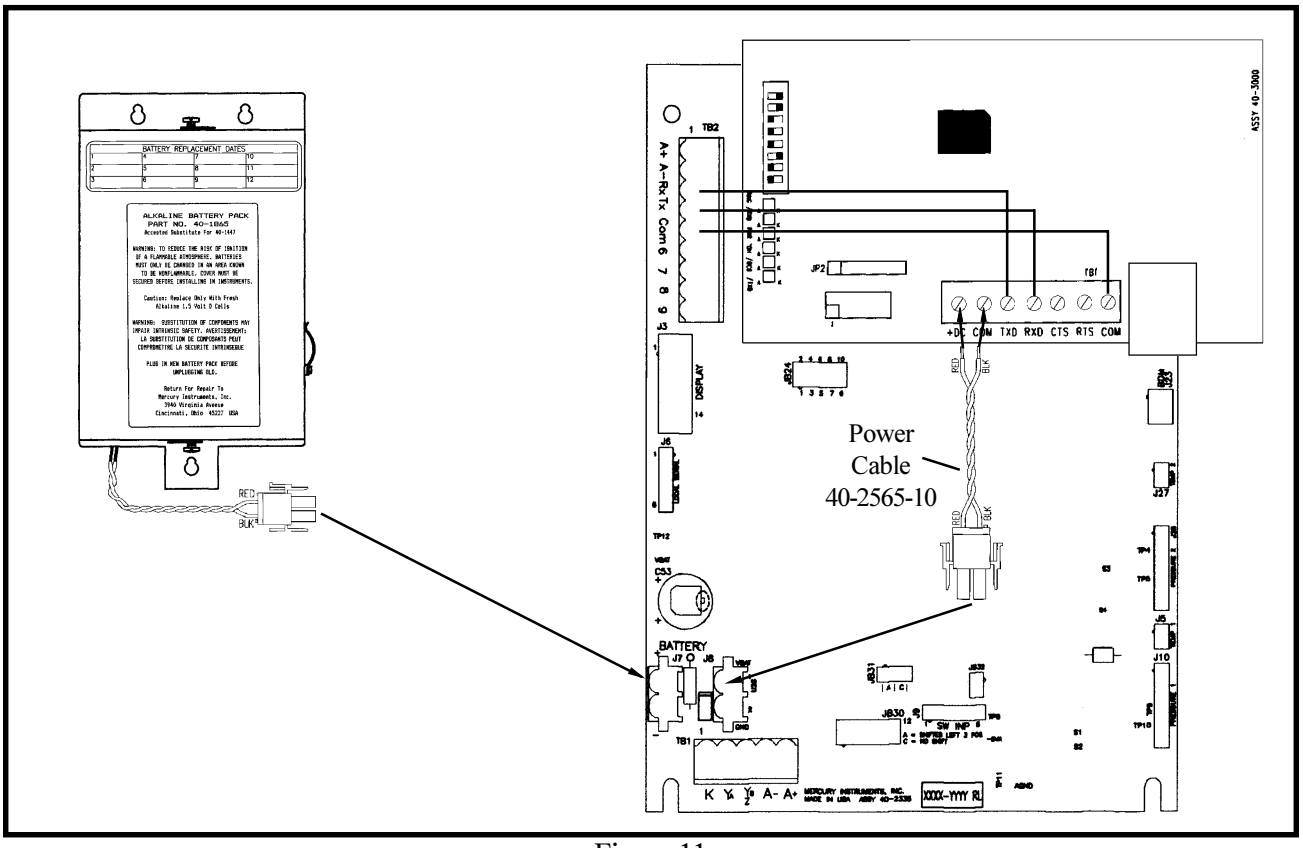


Figure 11
Mini-AT to Messenger Modem Connections

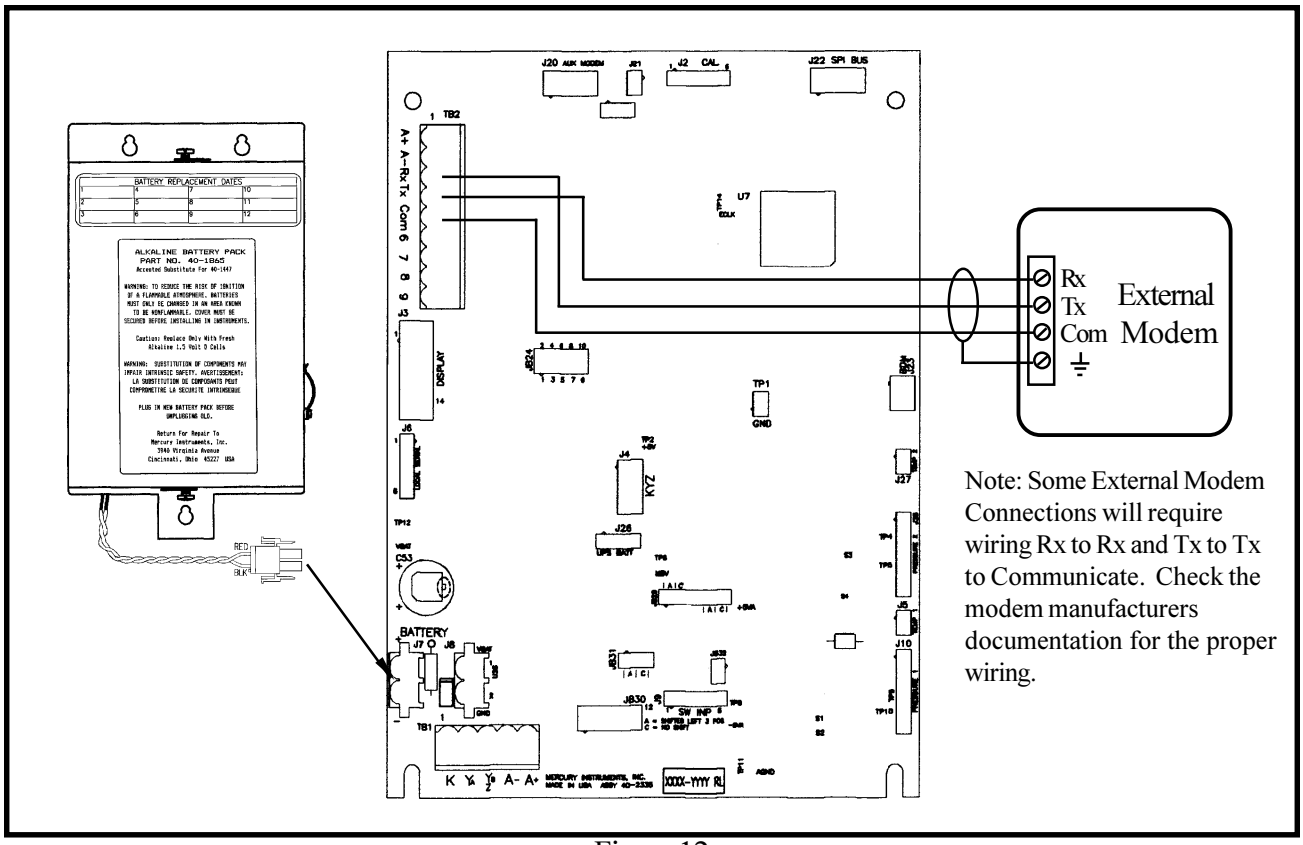


Figure 12
Mini-AT to External Modem Connections

Power Sharing Cable Assembly (p/n 40-2390)

Installing a Mercury Modem in a Mini-AT enclosure necessitates the sharing of a single battery pack. The power sharing cable allows an instrument and modem to operate from a single pack by reserving the power in a low battery for the instrument. The cable disconnects power from the modem when the battery is low.

The power sharing cable is a small electronic circuit board with two attached pigtail cables. A battery socket is mounted on the circuit board, and the two pigtails are terminated by battery plugs. One plug is directly connected to the socket and supplies power to the instrument. The other plug, via the circuit board, provides switched power for the modem. Power is switched off if battery voltage drops below a preset level (5.25 volts dc), and automatically restores if it rises above a higher level (6.40 volts dc).

The needs of the instrument dictate the battery voltage an which the modem must be disconnected. Battery packs are affected by temperature and this complicates the process of deciding when to disconnect the modem. A battery nearing end of life may reach the disconnection voltage on a cold night long before it cannot supply the modem during the day. To maximize modem availability and to prevent nuisance shutoffs, the power sharing cable automatically restores power to the modem when battery voltage returns to a acceptable level. To prevent a continuous cycling of power retries, a retry delay of about six hours is incorporated. This delay is cleared, or reset to zero whenever the battery is plugged into the cable, but can also be ended by pressing the small white push-button next to the red/black wire.

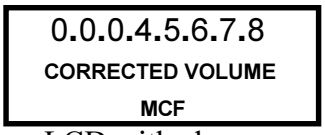
Installation
Plug the red/black pigtail connector into either of the battery sockets (J7 or J8) of the Mini-AT. Plug the white/black pigtail connector into either modem socket (J3 or J4). Lastly, plug the power connector from the battery pack of power supply into the power sharing cable board. At this point, you should see the modem LED's flash during its five to ten second initialization process. If the LED's do not flash, press the white button on the power sharing cable board. Place the power sharing cable circuit board in the instrument door to the right of the battery pack (when viewed with the door open) and place the cables in the battery wire clip so the board is toward the front surface of the door.

Note: The Messenger Modem does not require the Power Sharing Cable

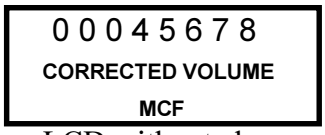
Alarms

The LCD on the Mini-AT's door will display decimal points between each numerical digit when the instrument has recognized an alarm.

Examples:



LCD with alarms



LCD without alarms

Use a Mag Wand (or push-button) to display the first alarm code onto the LCD. Continue scrolling with the Mag Wand to display additional alarms, if they exist. After displaying the last alarm code, continued use of the Mag Wand will cause the normal Meter Reader List to be displayed on the LCD. Table 4 is a listing of all alarms currently available from the Mini-AT.

Clearing Alarms

By default, the Mini-AT is configured to allow manually clearing of alarms using a Mag Wand. This feature is enabled by setting Item Code 128 (Mag Alarm Acknowledge) to "Yes". To clear all instrument alarms, scroll through the alarm codes until the LCD displays "E.E.E.E.E.E.E.E", then simply allow the display to timeout, which takes about 1-minute. After the "E.E.E.E.E.E.E.E" have timed-out, the LCD will display the first item of the Meter Reader List, usually the Display Test, "8.8.8.8.8.8.8.8". **The alarms can also be cleared using Mini-AT Link or MasterLink 32 software.**

Report By Exception

RBX (Report By Exception, Item Code 165) is another alarm function that must be enabled using Mini-AT Link or MasterLink32 software. When enabled, the RBX function automatically clears an instrument alarm **after** an alarm parameter has returned to its normal operating range, buffered by a user specified dead band. RBX will also clear the dots on the LCD when an alarm is cleared.

The Date and Time of all Mini-AT Alarms, Alarms Acknowledgment and Alarms Cleared are recorded in the Alarm Log regardless of whether RBX is enabled or if the alarms were cleared manually. Mini-AT Link software is used to download and generate an Alarm Report.

HELP Mode

When the Battery Voltage (Item 048) drops below the Shutdown Voltage (Item 050 usually 4.8 volts), the instrument enters HELP mode. In this mode the LCD will display ". .H.E.L.P. ." to signify that the battery voltage has reached a critical level. All instrument operations are suspended in this mode with the exception of Time. The batteries should be replaced immediately when the instrument is in HELP mode. After the replacing the batteries, if the voltage is above 4.8 volts, a mag wand input, or serial access will wake-up the instrument. This will allow the Mini-AT to function normally again.

Alarm Pulse Outputs

The Mini-AT will generate a Form-A, 100 millisecond wide pulse on every new alarm, and if RBX is enabled, on every alarm automatically cleared. The alarm pulse is available at terminals A- and A+ of TB1 and TB2. Item Code 108 (Alarms Output) will be logic 'High' (11111111) to indicate an alarm pulse has been transmitted.

ALARM DESCRIPTION	ITEM #	E-CODE	Ver. 6.0206	Ver. 6.1403	Ver. 6.5121	Ver. 6.7010
PULSER A OVER LIMIT	69	.E.0.6.9.	X	X	X	X
PULSER B OVER LIMIT	70	.E.0.7.0.	X	X	X	X
PULSER C OVER LIMIT	71	.E.0.7.1.	X	X	X	X
MAIN BATTERY LOW	99	.E.0.9.9.	X	X	X	X
BATT. CYCLES > LIMIT	100	.E.1.0.0.	X	X	X	X
MEMORY BATT LOW	101	.E.1.0.1.	X	X	X	X
INDEX SW #1 FAULT	102	.E.1.0.2.	X	X	X	X
INDEX SW #2 FAULT	103	.E.1.0.3.	X	X	X	X
A/D FAULT	104	.E.1.0.4.	X	X	X	X
PRESS OUT OF RANGE	105	.E.1.0.5.	X	X	X	X
TEMP OUT OF RANGE	106	.E.1.0.6.	X	X	X	X
PCOR PRESS LOW	143	.E.1.4.3.	X	X	X	X
TEMPERATURE LOW	144	.E.1.4.4.	X	X	X	X
PCOR PRESS HIGH	145	.E.1.4.5.	X	X	X	X
TEMPERATURE HIGH	146	.E.1.4.6.	X	X	X	X
FLOW RATE HIGH	163	.E.1.6.3.	X	X	X	X
RBX ALARM EVENT	176	.E.1.7.6.	X	X	X	X
DAILY CORVOL	222	.E.2.2.2.	X	X	X	X
PLOG PRESS HIGH	451	.E.4.5.1.		X	X	X
PLOG PRESS LOW	452	.E.4.5.2.		X	X	X
FLOW RATE LOW	461	.E.4.6.1.				X
REPLACE MAIN BATT (""SHUTDOWN"")	.H.E.L.P.	.H.E.L.P.	X	X	X	X

Table 4
Mini-AT Alarm Codes

Pulse Outputs

As a standard feature, the Mini-AT provides a corrected and uncorrected volume pulse output. The uncorrected volume pulse is generated from a reed switch mounted on the input switch board as the magnet disc rotates past switch S3 on each meter revolution. The uncorrected pulse may be wired as either Form-A (2 wires) or as Form-C (3 wire) at TB1 of the input switch board. The value of each pulse as determined by the meter type and size. Generally, each pulse represents the amount of uncorrected gas flow during a single meter revolution

The corrected volume pulse output is an electronic switch that operates much like an 'open collector' transistor. All Mini-AT electronic pulse outputs, including the alarm pulse, incorporate opto-isolators to electrically isolate the Mini-AT circuitry from the devices receiving the pulses. The volume pulse output can actually be user configured to output any of the listed pulse types.

- Corrected volume
- Uncorrected volume
- Pressure corrected volume
- Time (Time can only be used with a Form-A output to provide a reset switch at the top of each hour).

Use Mini-AT Link or MasterLink32 software to select the pulse type at Item Codes 093 and 094. See pages 43-44 for configuration examples.

The Mini-AT main board can be configured for either Form-A or Form-C volume pulse output. Jumpers at JB30 and JB31 (see Table 9 on page 73) determine whether a single channel, Form-C pulse output is available at terminals K, Y and Z of terminal strip TB1; or if two Form-A channels are available at terminals K & Ya and K & Yb of terminal strip TB1. Additionally, JB29 is used to configure the pulse width for Form-A pulses. For more information, refer to pages 39-41.

Unless otherwise specified, the Mini-AT is configured for Form-A pulse output. Shorting jumpers are installed on JB29 to provide a pulse width of 62.5 milliseconds, having a period of 125 milliseconds. Other pulse width durations are available by moving the shorting jumpers and replacing them with shunt resistors.

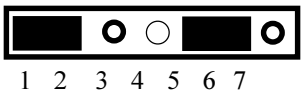
Configuring for Form-A volume pulse output

Jumpers JB29, JB30, and JB31 must be set correctly in order for the Mini-AT to provide a Form-A pulse output. Figure 9 will assist with locating these jumpers on the main board.

Install shorting jumpers at JB29 pins 1-2 and 5-6 to obtain pulse widths of 62.5 milliseconds or substitute with shunt resistors to obtain other pulse width values. The value of the shunt resistor determines the pulse width of the Form-A output. The chart below lists the shunt resistors available and the pulse width for each. Item 115 will also need to be changed accordingly. (See Table 6 on page 44)

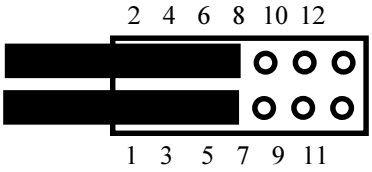
Form-A pulse width	part #	Jumper description
62.5 milliseconds	(40-2467)	shunt jumper
125 milliseconds	(40-2468)	125 mS resistor assembly
250 milliseconds	(40-2469)	250 mS resistor assembly
500 milliseconds	(40-2470)	500 mS resistor assembly
1.0 second		no jumper

1) Install shorting jumpers (40-2467) at JB29 pins 1-2 and 5-6



JB29

2) Install two (2) six position shorting jumpers on JB30, shifted pins to the left.

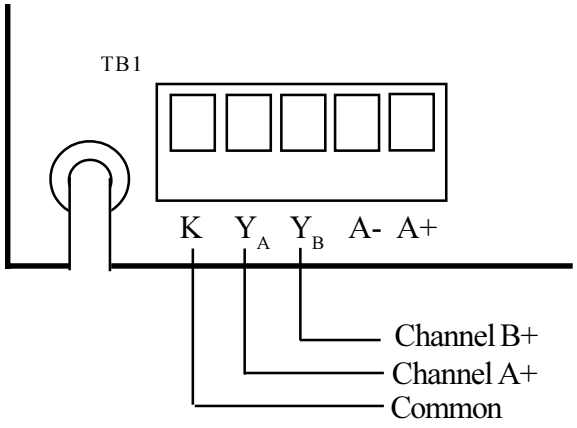


JB30

3) Install a shorting jumper at JB31 pin 1-2.

JB31

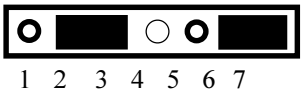
4) Connect the wiring as shown below.



Configuring for Form-C volume pulse output

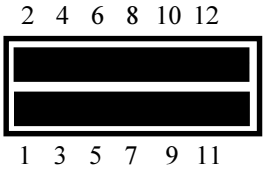
Jumpers JB29, JB30, and JB31 must be set correctly in order for the Mini-AT to provide a single Form-C pulse output. Figure 9 will assist with locating these jumpers on the main board.

1) Install shorting jumpers (40-2467) at JB29 pins 2-3 and 6- 7



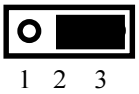
JB29

2) Install two (2) six position shorting jumpers at JB30 so that all six pins on the top row of pins are shorted together and all six pins on the bottom row are shorted together of pins JB30.



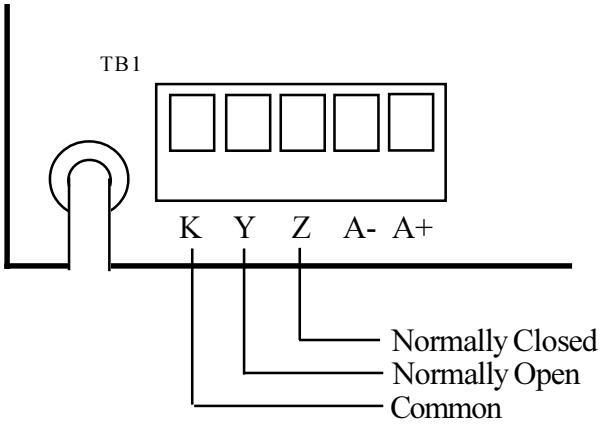
JB30

3) Install a shorting jumper at JB31 pin 2-3.



JB31

4) Connect wiring as shown below.



Note: Pulse width for Form C pulses can be adjusted by changing Item Code 115 using MasterLink32 or Mini-AT Link software.

Output Pulse Specifications

1. All outputs are isolated from ground and each other.

2. Outputs are rated for DC only, from 3.0 volts to 30.0 volts. Observe polarity.

3. The corrected volume pulser circuits will sink up to 15 milliamperes (DC) for Form-C outputs and up to 5 milliamperes (DC) for Form-A outputs.

4. The electronic Form-C volume output counts consist of contact closures between both the K- Y and the K-Z terminals. For proper counting, the receiving device must count both.

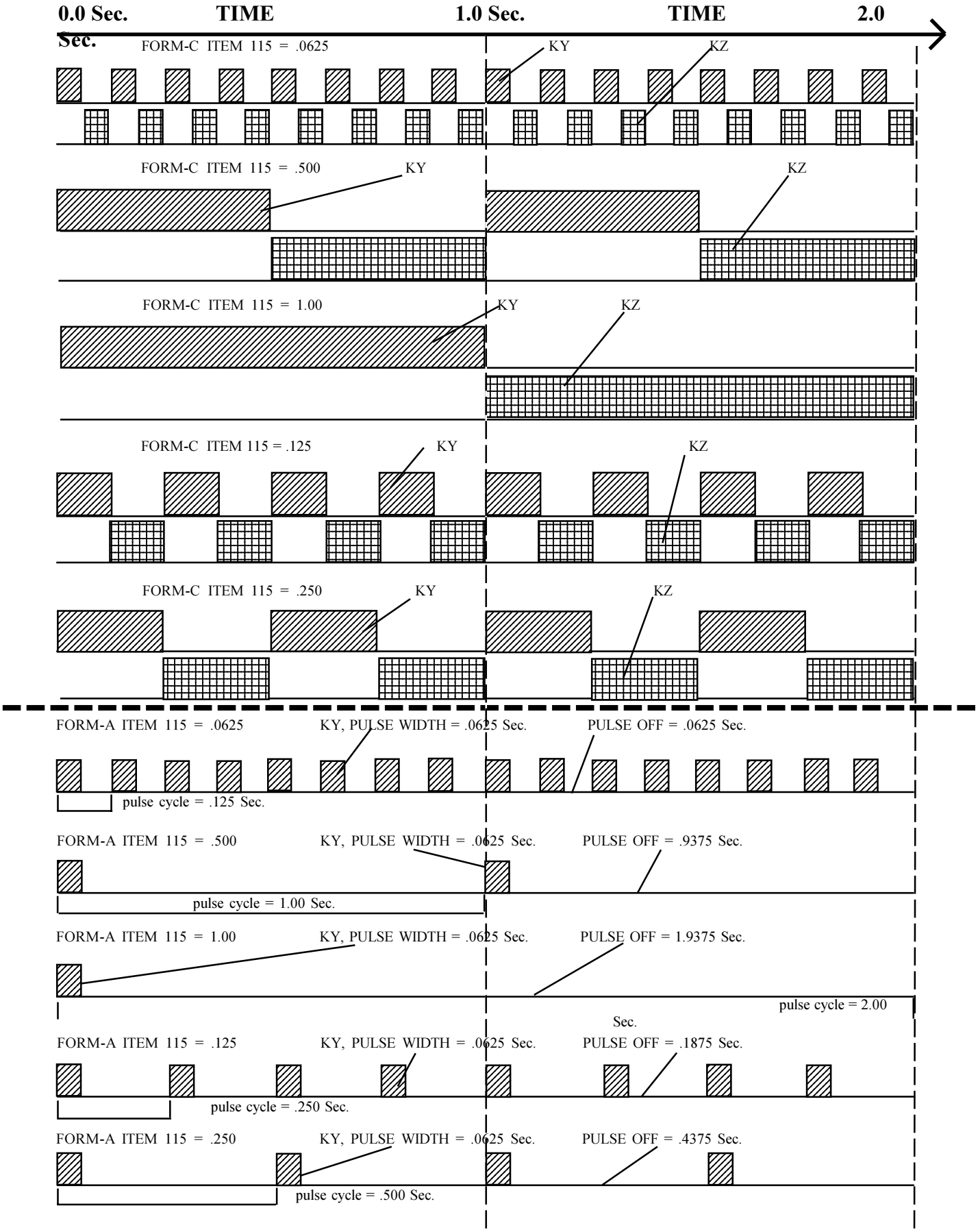
The pulse-off time for Form-A pulses can be varied by the selection of item 115. If the board jumpers are configured for Form-C, then Item Code 115 controls the pulse width of the Form-C pulses.

Select: **0** - 0.0625 Sec.------**Default**
1 - 0.5000 Sec.
2 - 1.0000 Sec.
3 - 0.1250 Sec.
4 - 0.2500 Sec.

Value at Item 115		Form C			Form A		
Code	(Sec)	Pulse Width Sec.	Pulse Cycle Sec.	Pulse Repetition Rate, CPS	Pulse Off Sec.	Pulse Cycle Sec.	Pulse Repetition Rate, CPS
0	0.0625	0.0625	0.0625	16	0.0625	0.125	8
1	0.5	0.5	0.5	2	0.9375	1	1
2	1	1	1	1	1.9375	2	0.5
3	0.125	0.125	0.125	8	0.1875	0.25	4
4	0.25	0.25	0.25	4	0.4375	0.5	2

Table 5
Output Pulse Codes

The pulse timing chart on the next page compares the relationship of Pulse Width, Pulse Cycle, Pulse Off Time and Pulse Repetition Rate.


0.0 Sec.
TIME
1.0 Sec.
TIME
2.0 Sec.
FORM-C ITEM 115 = .0625
KY
KZ
FORM-C ITEM 115 = .500
KY
KZ
FORM-C ITEM 115 = 1.00
KY
KZ
FORM-C ITEM 115 = .125
KY
KZ
FORM-C ITEM 115 = .250
KY
KZ
FORM-A ITEM 115 = .0625
KY, PULSE WIDTH = .0625 Sec.
PULSE OFF = .0625 Sec.
pulse cycle = .125 Sec.
FORM-A ITEM 115 = .500
KY, PULSE WIDTH = .0625 Sec.
PULSE OFF = .9375 Sec.
pulse cycle = 1.00 Sec.
FORM-A ITEM 115 = 1.00
KY, PULSE WIDTH = .0625 Sec.
PULSE OFF = 1.9375 Sec.
pulse cycle = 2.00 Sec.
FORM-A ITEM 115 = .125
KY, PULSE WIDTH = .0625 Sec.
PULSE OFF = .1875 Sec.
pulse cycle = .250 Sec.
FORM-A ITEM 115 = .250
KY, PULSE WIDTH = .0625 Sec.
PULSE OFF = .4375 Sec.
pulse cycle = .500 Sec.

Pulse Output Scaling Factor (Item 56 & 57) Form-A type output										
Selected Volume Units Item 90, 91 & 92	Desired Pulse Output Value									
Units	CuFt	CuFt X 10	CuFt X 100	CuFt X 1000	CuFt X 10,000	m3 X 0.1	m3 X 1	m3 X 10	m3 X 100	m3 X 1000
CuFt	2.00000	0.20000	0.02000	0.00200	0.00020	0.56634	0.05663	-----	-----	-----
CuFt x 10	20.00000	2.00000	0.20000	0.02000	0.00200	5.66340	0.56634	0.05663	-----	-----
CuFt x 100 (CCF)	-----	20.00000	2.00000	0.20000	0.02000	56.63400	5.66340	0.56634	0.05663	-----
CuFt x 1,000 (MCF)	-----	-----	20.00000	2.00000	0.20000	-----	56.63400	5.66340	0.56634	0.05663
CuFt x 10,000	-----	-----	-----	20.00000	2.00000	-----	-----	56.63400	5.66340	0.56634
m3 x 0.1	7.06290	0.70629	0.07063	-----	-----	2.00000	0.20000	0.02000	0.00200	0.00020
m3 x 1.0	70.62900	7.06290	0.70629	0.07063	-----	20.00000	2.00000	0.20000	0.02000	0.00200
m3 x 10	-----	70.62900	7.06290	0.70629	0.07063	-----	20.00000	2.00000	0.20000	0.02000
m3 x 100	-----	-----	70.62900	7.06290	0.70629	-----	-----	20.00000	2.00000	0.20000
m3 x 1,000	-----	-----	-----	70.62900	7.06290	-----	-----	-----	20.00000	2.00000

Table 6
Form A Pulse Output Scaling

Form-A Configuration Examples:

To configure the Mini-AT that is programmed for corrected and uncorrected volume in MCF (1000 CuFt) to output an MCF volume pulses via the two Form-A channels, configure the following items:

Item #	Description	Value
090	Corrected Volume Units	MCF
092	Uncorrected Volume Unite	MCF
056	Pulser A Scaling	2.0000
057	Pulser B Scaling	2.0000
093	Pulser A Volume Code	CorVol
094	Pulser B Volume Code	UncVol
115	Output Pulse Code	0.0625

To configure the Mini-AT that is programmed for corrected and uncorrected volume in CCF (100 CuFt) to output a CCF volume pulses via the two Form-A channels, configure the following items:

Item #	Description	Value
090	Corrected Volume Units	CCF
092	Uncorrected Volume Unite	CCF
056	Pulser A Scaling	2.0000
057	Pulser B Scaling	2.0000
093	Pulser A Volume Code	CorVol
094	Pulser B Volume Code	UncVol
115	Output Pulse Code	0.0625

Pulse Output Scaling Factor (Item 56 & 57) Form-C type output										
Selected Volume Units Item 90, 91 & 92	Desired Pulse Output Value									
Units	CuFt	CuFt X 10	CuFt X 100	CuFt X 1000	CuFt X 10,000	m3 X 0.1	m3 X 1	m3 X 10	m3 X 100	m3 X 1000
CuFt	1.00000	0.10000	0.01000	0.00100	0.00010	0.28317	0.02831	-----	-----	-----
CuFt x 10	10.00000	1.00000	0.10000	0.01000	0.00100	2.83170	0.28317	0.02831	-----	-----
CuFt x 100 (CCF)	-----	10.00000	1.00000	0.10000	0.01000	28.31700	2.83170	0.28317	0.02831	-----
CuFt x 1,000 (MCF)	-----	-----	10.00000	1.00000	0.10000	-----	28.31700	2.83170	0.28317	0.02831
CuFt x 10,000	-----	-----	-----	10.00000	1.00000	-----	-----	28.31700	2.83170	0.28317
m3 x 0.1	3.53140	0.35314	0.03531	-----	-----	1.00000	0.10000	0.01000	0.00100	0.00010
m3 x 1.0	35.31400	3.53140	0.35314	0.03531	-----	10.00000	1.00000	0.10000	0.01000	0.00100
m3 x 10	-----	35.31400	3.53140	0.35314	0.03531	-----	10.00000	1.00000	0.10000	0.01000
m3 x 100	-----	-----	35.31400	3.53140	0.35314	-----	-----	10.00000	1.00000	0.10000
m3 x 1,000	-----	-----	-----	35.31400	3.53140	-----	-----	-----	10.00000	1.00000

Table 7
Form C Pulse Output Scaling

Form-C Configuration Examples:

To configure the Mini-AT that is programmed for corrected volume in MCF (1000 CuFt) to output an MCF corrected volume pulses via the single* form C channel, configure the following items:

Item #	Description	Value
090	Corrected Volume Units	MCF
056	Pulser A Scaling	1.0000
093	Pulser A Volume Code	CorVol
094	Pulser B Volume Code	No Out
115	Output Pulse Code	0.0625

To configure the Mini-AT that is programmed for corrected volume in CCF (100 CuFt) to output a CCF corrected volume pulses via the single* form C channel, configure the following items:

Item #	Description	Value
090	Corrected Volume Units	CCF
056	Pulser A Scaling	1.0000
093	Pulser A Volume Code	CorVol
094	Pulser B Volume Code	No Out
115	Output Pulse Code	0.0625

*Note: Only one form C channel is available.

Mini-AT Operating Modes

While in service, the Mini-AT is always in one of four operating modes. The operation of the instrument in each state is well defined and suited to a particular purpose. The four states are referred to as "Operating Modes" and are:

Corrector Mode
Meter Reader Mode
Level 1 Access Mode
Level 2 Access Mode

In all four Modes, the Mini-AT may be receiving and processing uncorrected volume, pressure and the temperature input from the meter. The Level 2 Access Mode was originally intended to be used in the meter or instrument shop, however, it is common practice for field use also.

Note: The Mini-AT can only enter Meter Reader Mode, Level 1 Access Mode, or Level 2 Access Mode from Corrector Mode. If the instrument is in Meter Reader Mode, it must be brought back to Corrector Mode to enter Level 1 or Level 2 Access Mode. The same is true if the Mini-AT is in Level 1 or Level 2 Access Mode, the instrument must be brought back to Corrector Mode to enter Meter Reader Mode.

Corrector Mode

The Mini-AT normally operates in the Corrector Mode. The other three modes always return to the Corrector Mode when completed. The corrected volume continuously appears on the LCD display while the uncorrected volume is displayed on the mechanical index in the mounting bracket.

Uncorrected volume pulses are detected by magnetically actuated reed switches at each meter revolution. The instrument electronics are normally in a standby (asleep) mode, but are activated (wake-up) by an input pulse generated from the reed switches. During a wake-up, the instrument measures the gas pressure and temperature, then calculates the correction factors and updates the corrected volume on the LCD display. The electronic circuitry returns to the asleep mode to conserve battery power until the next full rotation of the meter output shaft.

Meter Reader Mode

This mode provides the meter reader the ability to view instrument item values in addition to the corrected volume without opening the door. By running a magnet activator along the right edge of the display window on the door, the meter reader can scroll through a sequence of readings. These readings include up to 18 parameter values, alarms, live gas pressure and live gas temperature, if desired.

At the time the meter reader activates the unit with the first mag wand input, the unit updates all measurements and then displays the LCD Display Test. This is to verify that all seven segments and decimal points of the eight digit LCD are functional. The uncorrected volume continues to totalize on the mechanical index. When the instrument receives a mag wand input while the last Meter Reader List item is displayed, the unit will return to the Corrector Mode. If the Meter Reader List sequence has not been completed, the unit returns to the Corrector Mode automatically after a one minute timeout period (unless the instrument is displaying live pressure or live temperature, in which case, the time-out period is 10 minutes). Input pulses that accumulated while in Meter Reader Mode will be processed just prior to returning to Corrector Mode.

Level 1 Access Mode

Level 1 Access is considered a lower level access to instrument functions and is gained through the use of a laptop computer. Level 1 Access is a software function using the instrument's companion software Mini-AT Link (or MasterLink32), but requires the instrument to be connected to the computers RS-232 serial port. The user must enter a valid five digit access code at the computer's keyboard to gain software access, the default code is: "11111". (See Mini-AT Link SOFTWARE USER'S Guide for additional information on using Mini-AT Link functions.)

Level 1 Access permits instrument calibration for pressure and temperature. A limited number of parameters may be displayed and changed if authorized. Also, Audit Trail downloads, Event Log downloads, Alarm Log Downloads and Alarms viewing and clearing are possible, if authorized. When attempting to establish a serial link to the instrument, the software will request the user to input a five digit Instrument Access Code. This access code is necessary to maintain instrument security. The default Instrument Access Code is: 33333. This access code may be changed if desired, but requires Level 2 Access.

While the instrument is in Level 1 Access, the unit keeps track of incoming uncorrected pulses. Corrected and uncorrected totals are updated when exiting Level 1 Access, using values of pressure and temperature measured just before exiting. The pressures and temperatures applied during any calibration process are not used for any of the correction calculations.

Note: Be sure line pressure and temperature are restored before exiting Level 1 Access, otherwise improper correction factors will be applied to any stored input pulses.

Level 2 Access Mode

The Level 2 Access Mode allows the factory or the user to configure the Mini-AT instrument. Level 2 Access is considered a higher level access to all instrument functions and is gained through the use of a laptop computer. Level 2 Access is also a software function using the instrument's companion software Mini-AT Link (or MasterLink32). The user must enter a five digit access code (default: 22222) at the computer's keyboard. (See Mini-AT Link SOFTWARE USER'S Guide for additional information on using Mini-AT Link functions.)

Level 2 Access permits instrument calibration and configuration. Any instrument parameter may be displayed and changed. When attempting to establish a serial link to the instrument, the software will request the user to input a five digit Instrument Access Code. This access code is necessary to maintain instrument security. The default Instrument Access Code is: 33333. This access code may be changed, if desired, when the user is at Level 2 Access.

While the instrument is in Level 2 Access, the unit keeps track of incoming uncorrected pulses. Corrected and uncorrected totals are updated when exiting Level 2 Access, using values of pressure and temperature measured just before exiting. The pressures and temperatures applied during any calibration process are not used for any of the correction calculations or updating the LCD.

Note: Be sure line pressure and temperature are restored before exiting Level 2 Access, otherwise improper correction factors will be applied to any stored input pulses.

Level 1 & Level 2 Access Modes permits data transfer to and from the instrument's on-board memory. Any RS-232 serial device can be connected to the instrument's serial port, but the serial device must be able to communicate using Mercury's serial data protocol.

A Mercury Modem or Messenger Modem may be installed in the Mini-AT enclosure and share power from the main battery (see wiring diagram on page 135. Modem operation is supported by a second serial port, TB2. Modems are generally used to transfer data (audit trail) from a remote location to a host computer. All RS-232 devices require Mercury's Serial Protocol for Mini-AT in the communication driver.

Meter Reader Mode (Detailed Description)

During normal operation, the Mini-AT is operating in the Corrector Mode. To obtain information in addition to corrected and uncorrected volume, any person with a magnetic wand may access the instrument's Meter Reader Mode. The Meter Reader Mode provides the ability to display a predetermined number of items on the LCD display without opening the instrument door. The number of selected items to be viewed can range from none to eighteen. The selected items may be any of the instrument's item codes.

Upon entering the Meter Reader Mode, any active alarm(s) is always displayed prior to the selected items. When enabled, the Mag Alarm Acknowledge (item # 128) will permit all alarms to be cleared using the mag wand.

If desired, live gas pressure and live gas temperature may be included as part of the meter reader list. While displaying live pressure or live temperature, a single point calibration may be performed if a Mercor Mini Field Calibrator is connected to connector J2 on the main circuit board. The live parameters have a 10 minute time-out to provide enough time to complete the calibration process.

Gaining Access To Meter Reader Mode

To gain access to the Meter Reader Mode, run the red tip of the magnet activator (mag wand) along the right side of the Corrected Volume LCD window, see figure 13. Upon entering the Meter Reader Mode, the LCD will go blank for about 1-second. The transmission of volume pulses is suspended while in this mode. The instrument takes a pressure and temperature measurement and recalculates all item values prior to an LCD display.

Fig. 13
Position of Mag Wand to Activate
Meter Reader Mode

Default Meter Reader Display

While in the Meter Reader Mode, the Mini-AT continues to recognize and accumulate meter input pulses. Also, 1-minute and 10-minute Time-outs are used to automatically return the instrument to the Corrector Mode. By design, the Corrector Mode requires much less electrical energy than all other operating modes. The time-out periods are safeguards to insure that the batteries are not needlessly wasted.

Refer to figure 15 on page 50 which is a flowchart of the default meter reader list. After the initial mag wand input, the Mini's operating program determines if there are any active alarms. The presence of active alarms, while in the Corrector Mode, is indicated by displaying all decimal points in the corrected volume display. If there are active alarms, all active alarm codes are displayed before the normal meter reader list items are displayed.

Note: While in the alarm display routine, all alarms will be cleared, if the instrument is allowed to time-out (60 seconds) during the display of the "E.E.E.E.E.E.E.E" and Item Code 128 is set to "Yes". If the instrument receives a mag wand input during the "E.E.E.E.E.E.E.E" display, the alarms are not cleared and the sequence moves to the "Display Test" display.

The "Display Test" should always be configured as the first meter reader list item. It provides a visual means of verifying that all LCD segments and decimal points are fully functional. If the "Display Test" does not appear as in figure 14 on page 49, the remaining item code values may not be accurate.

When the Mini-AT receives a mag wand input during the "Display Test", the current value for Uncorrected Volume is displayed. Each additional mag wand input will cause the next item code value to scroll onto the LCD. The items assigned to the default meter reader list are comprised of Item Codes 130-135, 129 and 75-83.

Listed below is the default Mini-AT meter reader list in the proper sequence:

ITEM#	ITEM DESCRIPTION
061	DISPLAY TEST
002	UNCORRECTED VOLUME
000	CORRECTED VOLUME
---	GAS PRESSURE (LIVE)
---	GAS TEMPERATURE (LIVE)
200	SITE ID
113	HIGH RESOLUTION CORVOL
013	BASE PRESSURE
014	ATMOSPHERIC PRESSURE
025	TRANSDUCER RANGE
044	PRESSURE CORRECTION FACTOR
043	TOTAL CORRECTION FACTOR
048	BATTERY VOLTAGE
031	CASE TEMPERATURE
203	TIME
204	DATE

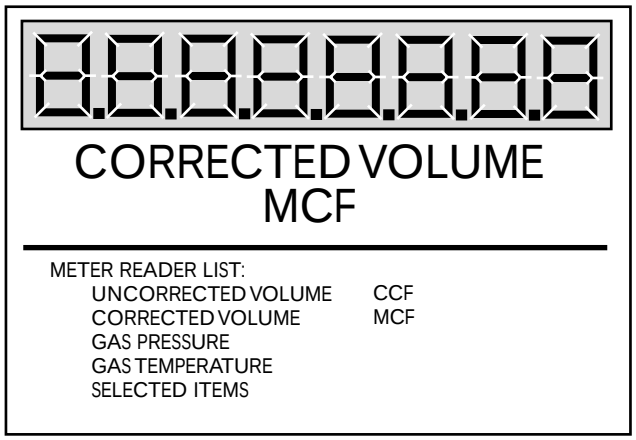
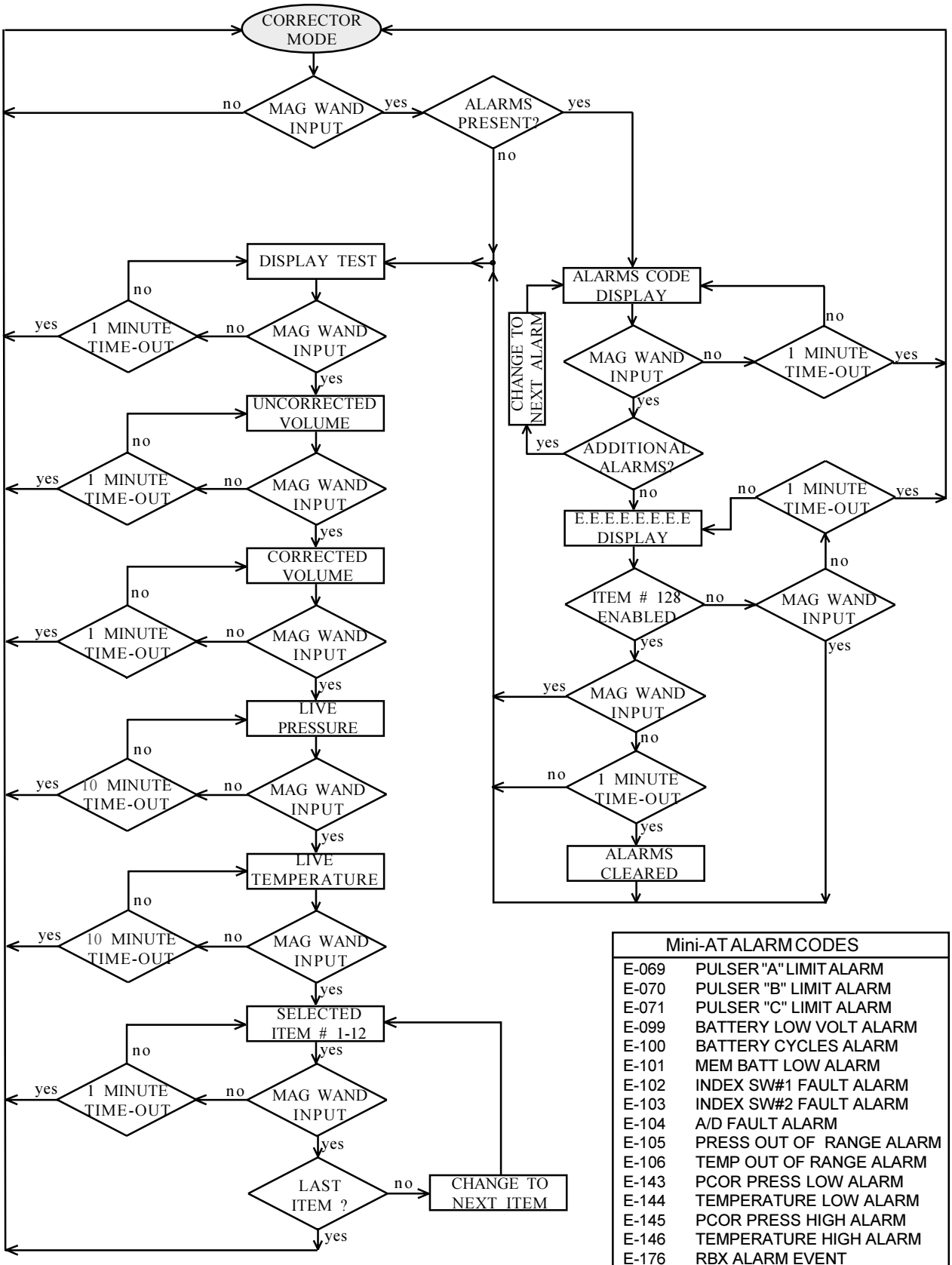


Fig. 14
Display Test
and
Default Window Label

While the last meter reader item is displayed, the next mag wand input will cause the LCD to go blank for 1-second while the instrument processes any stored uncorrected input pulses, prior to returning to the Corrector Mode

Listed below is the configuration of item codes required to create the default Mini-AT Meter Reader List.

Item Code#	Item Legend	Selected Item	Description
130	Mag List 1 Item #1	061	Display Test
131	Mag List 1 Item #2	002	Uncorrected Volume
132	Mag List 1 Item #3	000	Corrected Volume
133	Mag List 1 Item #4	255	End-of-List
134	Mag List 1 Item #5	255	End-of-List
135	Mag List 1 Item #6	255	End-of-List
129	Live Display Enable	Live P&T	Live Pressure & Temperature
075	Mag List 2 Item #1	200	Site ID
076	Mag List 2 Item #2	113	High Resolution CorVol
077	Mag List 2 Item #3	013	Base Pressure
078	Mag List 2 Item #4	014	Atmospheric Pressure
079	Mag List 2 Item #5	025	Transducer Range
080	Mag List 2 Item #6	044	Pressure Correction Factor
081	Mag List 2 Item #7	043	Total Corrector Factor
082	Mag List 2 Item #8	048	Battery Voltage
083	Mag List 2 Item #9	031	Case Temperature
084	Mag List 2 Item #10	203	Time
085	Mag List 2 Item #11	204	Date
086	Mag List 2 Item #12	255	End-of-List



Mini-AT ALARM CODES	
E-069	PULSER "A" LIMIT ALARM
E-070	PULSER "B" LIMIT ALARM
E-071	PULSER "C" LIMIT ALARM
E-099	BATTERY LOW VOLT ALARM
E-100	BATTERY CYCLES ALARM
E-101	MEM BATT LOW ALARM
E-102	INDEX SW#1 FAULT ALARM
E-103	INDEX SW#2 FAULT ALARM
E-104	A/D FAULT ALARM
E-105	PRESS OUT OF RANGE ALARM
E-106	TEMP OUT OF RANGE ALARM
E-143	PCOR PRESS LOW ALARM
E-144	TEMPERATURE LOW ALARM
E-145	PCOR PRESS HIGH ALARM
E-146	TEMPERATURE HIGH ALARM
E-176	RBX ALARM EVENT
E-222	DAILY CORVOL ALARM
E-451	PLOG PRESS HIGH ALARM
E-452	PLOG PRESS LOW ALARM

Fig. 15
Flow-diagram of Default Meter Reader List

The meter reader list is divided into four sections and can only be displayed in the following order:

MAG LIST SECTIONS	DESCRIPTION	
1	**Alarm Codes**	(Displayed only if any alarms are active)
2	**Mag List 1**	(Item codes 130-135)
3	**Live Parameter Display**	(Item code 129)
4	**Mag List 2**	(Item codes 075 - 086)

Except for the Alarm Codes, each subsection listed above is configurable. Refer to the descriptions below and the flowchart in figure 15 on page 50 for configuration details and the sequence of events that occur during a non-default meter reader list.

Mag List 1

Mag List 1 consists of six item codes (130-135) which define what items will appear in section 2 of the meter reader list. Normally, Display Test, Uncorrected Volume and Corrected Volumes are the item assigned to Mag List 1. However, any instrument item code can be placed into Mag List 1. If less than six items are required, place the value "255" into the item code location after the last desired Mag List 1 item. When the Mag List 1 item values are displayed, all eight digits on the LCD are used, unless the volume items are configured for fewer digits using Item Codes 096 and 097.

Example #1:
Suppose Display Test, Corrected Volume, Uncorrected Volume, Gas Pressure and Gas Temperature are the only items desired for Mag List 1. Since only five items are listed, the Mag List 1 configuration would appear as follows:

Item Code#	Item Legend	Selected Item Item	Description
130	Mag List 1 Item 1 #	061	Display Test
131	Mag List 1 Item 2 #	000	Corrected Volume
132	Mag List 1 Item 3 #	002	Uncorrected Volume
133	Mag List 1 Item 4 #	008	Gas Pressure (not Live)
134	Mag List 1 Item 5 #	026	Gas Temperature (not Live)
135	Mag List 1 Item 6 #	255	(End-Of-List)

Live Parameters Display

The Live Parameter Display will allow up to three parameters to appear in section 3 of the meter reader list. The only three parameters that may be a live display are: Live PCor Gas Pressure, Live Gas Temperature and Live PLog Gas Pressure. These should not be confused with item codes 008 (PCor Gas Pressure), 026 (Gas Temperature) and 420 (PLog Gas Pressure). If item codes 008, 026 and 420 are part of the meter reader list, the values displayed are PCor gas pressure, gas temperature, and PLog gas pressure placed into memory at the time of the initial mag wand input, not live readings. When item codes 008, 026 or 420 are encountered during a Meter Reader Mode, the values previously placed in memory are recalled and then displayed.

The purpose of providing a Live Gas Pressure and Live Gas Temperature is twofold. First, it will allow the meter technician to monitor the gas pressure without attaching a portable pressure gauge. Second, the meter technician can attach a Mercor Mini Field Calibrator to J2 on the main circuit board and perform a single point pressure or temperature calibration. Hence, the instrument can be calibrated without the need of a laptop computer.

The option selected at Item Code 129 (Live Display Enable) determines which live parameter, if any, will be displayed ***after*** the display of the last Mag List 1 item. The available selections using Mini-AT Link (or MasterLink32) are:

None	Live PLog
Live PCor	Live PCor & PLog
Live T	Live PLog & T
Live PCor & T	Live PCor, T & PLog

Example #2:
Suppose Display Test, Corrected Volume, Uncorrected Volume, Live Gas Pressure and Live Gas Temperature are the only items desired for the meter reader list. Since items 008 and 026 do not provide a live reading, it is necessary to configure Item Code 129 as shown below:

Note: Remember, all Mag List 1 & 2 items have a 1-minute time-out and both live parameters have a 10-minute time-out.

Item Code#	Item Legend	Selected Item	Description
075	Mag List 2 Item 1 #	255	(End-Of-List)
129	Live Display Enable	Live PCor&T	Live PCor Pressure & Temperature
130	Mag List 1 Item 1 #	061	Display Test
131	Mag List 1 Item 2 #	000	Corrected Volume
132	Mag List 1 Item 3 #	002	Uncorrected Volume
133	Mag List 1 Item 4 #	255	(End-Of-List)
134	Mag List 1 Item 5 #	255	(End-Of-List)
135	Mag List 1 Item 6 #	255	(End-Of-List)

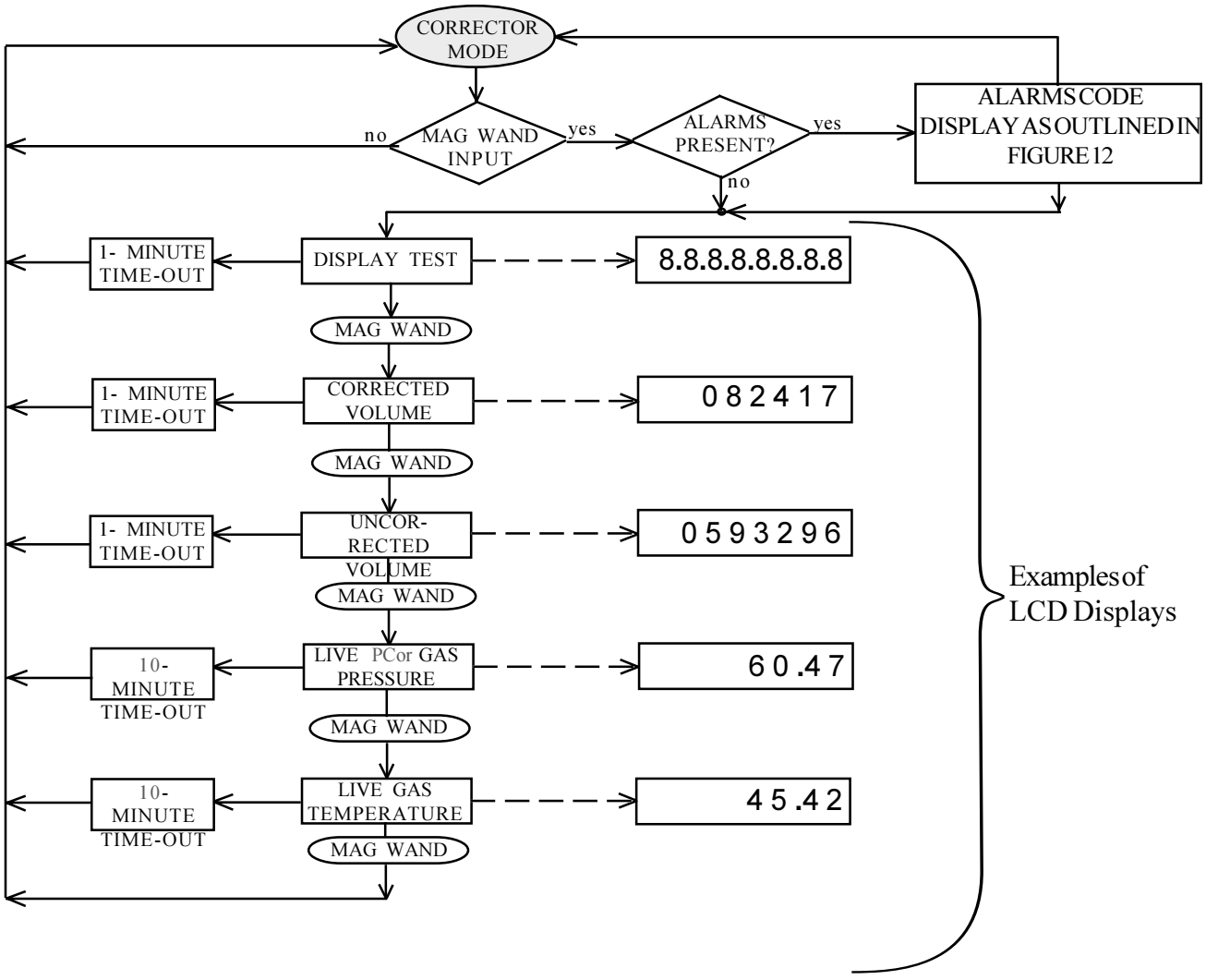


Fig. 16
Meter Reader List For Example # 2

Mag List 2

Mag List 2 consists of twelve item codes (075-086) which define what items will appear in section 4 of the meter reader list. The factory default items are listed below, however any Mini-AT item code can be placed into Mag List 2. If less than twelve items are required, place the value "255" into the item code location after the last desired Mag List 2 item.

Item Code#	Item Legend	Selected Item	Description
075	Mag List 2 Item 1 #	200	Site ID
076	Mag List 2 Item 2 #	113	High Resolution CorVol
077	Mag List 2 Item 3 #	013	Base Pressure
078	Mag List 2 Item 4 #	014	Atmospheric Pressure
079	Mag List 2 Item 5 #	025	Transducer Range
080	Mag List 2 Item 6 #	044	Pressure Correction Factor
081	Mag List 2 Item 7 #	043	Total Correction Factor
082	Mag List 2 Item 8 #	048	Battery Voltage
083	Mag List 2 Item 9 #	031	Case Temperature
084	Mag List 2 Item 10#	203	Time
085	Mag List 2 Item 11#	204	Date
086	Mag List 2 Item 12#	255	(End-Of-List)

Example #3:
Suppose Display Test, Site ID, Corrected Volume, Uncorrected Volume, Live Gas Pressure, Live Gas Temperature, Gas Pressure Maximum, Unsquared Super, Battery Voltage and Case Temperature are the only items desired for the meter reader list. The item code numbers listed below would be configured as follows:

Item Code#	Item Legend	Selected Item	Description
075	Mag List 2 Item 1 #	009	Gas Pressure Maximum
076	Mag List 2 Item 2 #	047	Unsquared Super
077	Mag List 2 Item 3 #	048	Battery Voltage
078	Mag List 2 Item 4 #	031	Case Temperature
079	Mag List 2 Item 5 #	255	(End-Of-List)
080	Mag List 2 Item 6 #	255	(End-Of-List)
081	Mag List 2 Item 7 #	255	(End-Of-List)
082	Mag List 2 Item 8 #	255	(End-Of-List)
083	Mag List 2 Item 9 #	255	(End-Of-List)
084	Mag List 2 Item 10#	255	(End-Of-List)
085	Mag List 2 Item 11#	255	(End-Of-List)
086	Mag List 2 Item 12#	255	(End-Of-List)
129	Live Display Enable	Live PCor&T	Live PCor Pressure & Temperature
130	Mag List 1 Item 1 #	061	Display Test
131	Mag List 1 Item 2 #	200	Site ID
132	Mag List 1 Item 3 #	000	Corrected Volume
133	Mag List 1 Item 4 #	002	Uncorrected Volume
134	Mag List 1 Item 5 #	255	(End-Of-List)
135	Mag List 1 Item 6 #	255	(End-Of-List)

Note: Remember that all Mag List 1 and Mag List 2 items have a 1-minute time-out. Both live parameters have a 10-minute time-out.

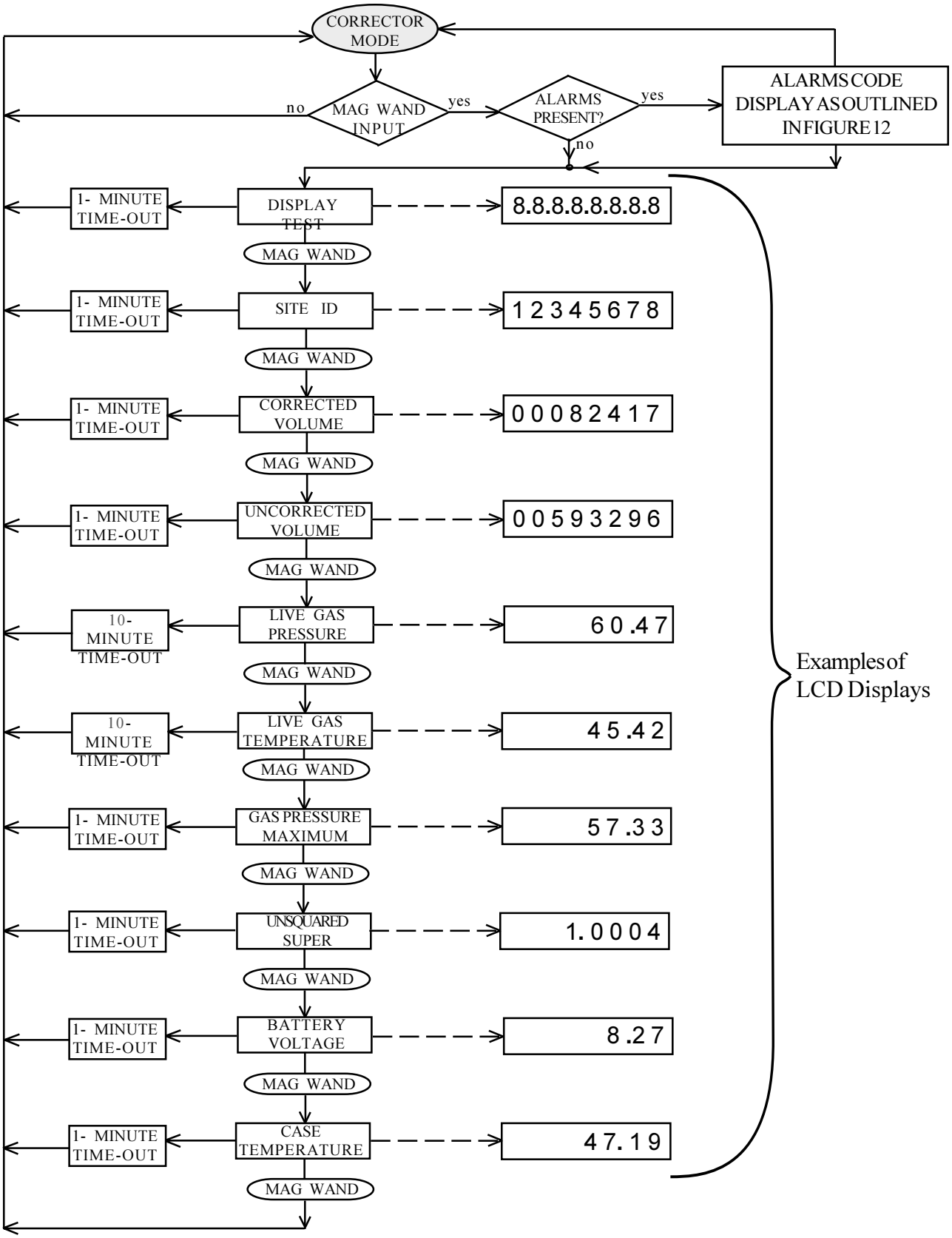


Fig. 17
Meter Reader List For Example # 3

Item Number Enable

Item Code 136, Item Number Enable, provides identification of the displayed mag list items. The default configuration of Mag List 1 and Mag List 2 provides no item identification. When the Item Number Enable feature is enabled, the meter reader list will include the display of the list's sequence number and the item code number for the value that will be displayed on the next mag wand input. This feature is available for Mag List 1, Mag List 2 and Live Display items. Although this feature is functionally the same for both mag list 1 and 2 , there is a slight difference in the display of sequence numbers. Mag List 1 items include a leading zero while Mag List 2 items do not. Live display items are indicated by the letter 'L' and a number. (e.g. L1---008 is Live PCor Gas Pressure) This difference will allow the user to determine if the LCD is displaying is a Mag List 1, Mag List 2 or Live item.

The Item Number Enable provides eight possible options. Use Mini-AT Link software to select which mag list is to include the item code identification. The eight options are:

None	Live
List 1	List 1, Live
List 2	List 2, Live
List 1 & 2	List 1 & 2, Live

Example #4:
Suppose Display Test, Site ID, Corrected Volume, Uncorrected Volume, Live Gas Pressure, Live Gas Temperature, Gas Pressure Maximum, Unsquared Super, Battery Voltage and Case Temperature are the only items desired for the meter reader list. However item number identification is also desired for both mag lists. The item code numbers listed below would be configured as follows:

Item Code#	Item Legend	Selected Item	Description
075	Mag List 2 Item 1 #	009	Gas Pressure Maximum
076	Mag List 2 Item 2 #	047	Unsquared Super
077	Mag List 2 Item 3 #	048	Battery Voltage
078	Mag List 2 Item 4 #	031	Case Temperature
079	Mag List 2 Item 5 #	255	(End-Of-List)
080	Mag List 2 Item 6 #	255	(End-Of-List)
081	Mag List 2 Item 7 #	255	(End-Of-List)
082	Mag List 2 Item 8 #	255	(End-Of-List)
083	Mag List 2 Item 9 #	255	(End-Of-List)
084	Mag List 2 Item 10#	255	(End-Of-List)
085	Mag List 2 Item 11#	255	(End-Of-List)
086	Mag List 2 Item 12#	255	(End-Of-List)
129	Live Display Enable	Live PCor &T	Live PCor Pressure & Temperature
130	Mag List 1 Item 1 #	061	Display Test
131	Mag List 1 Item 2 #	200	Site ID
132	Mag List 1 Item 3 #	000	Corrected Volume
133	Mag List 1 Item 4 #	002	Uncorrected Volume
134	Mag List 1 Item 5 #	255	(End-Of-List)
135	Mag List 1 Item 6 #	255	(End-Of-List)
136	Item Number Enable	List 1 & 2	Item Number Identification for Mag List 1 and Mag List 2

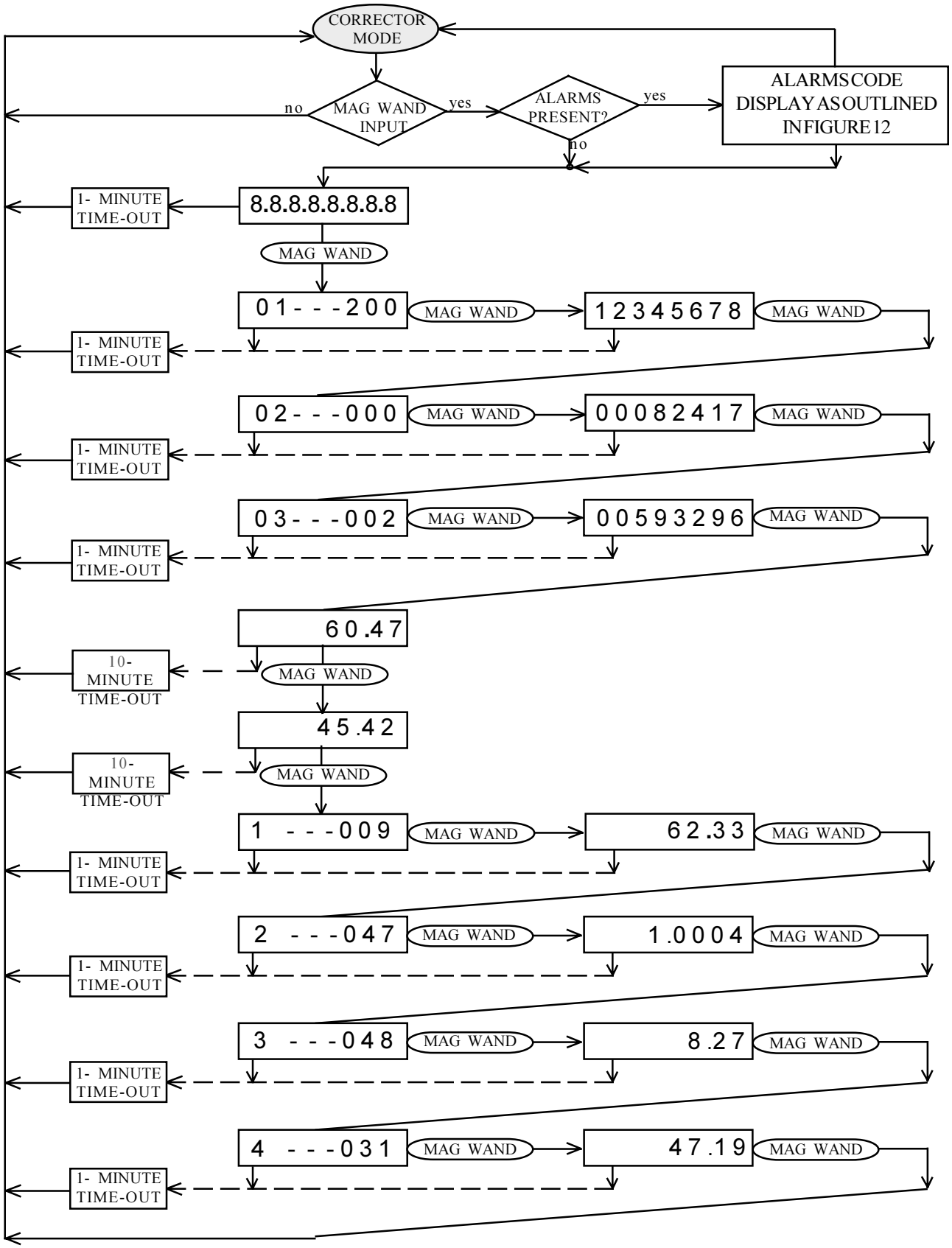


Fig. 18
Meter Reader List For Example # 4

Flow Rate Calculations

The Mini-AT calculates corrected and uncorrected gas flow rates. There are two types of calculations made for corrected and one type for uncorrected volume. The calculations are:

Average Flow Rate (Item 208) - the average amount of corrected volume flow per Log Interval (Item 202), expressed in Cor Vol Units (Item 090) per hour.

Instantaneous Flow Rate (Item 209) - the instantaneous amout of corrected volume flow, expressed in Cor Vol Units (Item 090) per hour.

Instantaneous Dial Rate (Item 218) - the instantaneous amount of uncorrected volume flow, expressed in cubic foot per hour.

Note: Instantaneous Rates are based on the duration of time between the last two input pulses.

The Instantaneous Flow and Dial Rate calculations require two conditions to be satisfied before calculations can be made. The first is, at least two correction cycles have occurred, and the second is that one minute must have elapsed. If both conditions are not satisfied, then the Instantaneous Flow and Dial Rates will remain constant until the next point at which the conditions are satisfied.

Zero Flow Calculation

Based on the method described above, the flow rate will not be able to indicate a flow rate zero. A Zero-Flow Detection algorithm has been developed (Mini-AT firmware 6.60 and higher) to check for a zero flow condition. This algorithm calculates the expected time for the next meter input from the average time between the five previous meter inputs, added to the time period of the most recent consecutive switch input. The Mini-AT will ‘wake up’ once a minute to check and see if the expectation time has been exceeded. If the expectation time is exceeded and there has not been a switch input, the instantaneous dial and flow rates are set to zero.

The expectaion time can be scaled by changing a multiplier stored at item 460. The default value of item 460 is 2. Thus the expectation time would be scaled by a factor of 2. If Item 460 is set to zero, the Zero-Flow Detection calculation is disabled.

Audit Trail

The Mini-AT records operational information on a user-selectable interval. At the beginning of each INTERVAL (item 202), the instrument records either four or ten items into memory. The default settings are:

Selectable Report Items

1. Item Code 258: 225 Incremental Corrected Volume
2. Item Code 259: 226 Incremental Uncorrected Volume
3. Item Code 260: 206 Average Pressure
4. Item Code 261: 207 Average Temperature

Optional Report Items

1. Item Code 229: 048 Battery Voltage
2. Item Code 230: 000 Corrected Volume
3. Item Code 231: 002 Uncorrected Volume
4. Item Code 232: 008 PCor Gas Pressure
5. Item Code 233: 026 Gas Temperature
6. Item Code 234: 059 Battery Wake Cycles

The Mini-AT will store 140 days of hourly information for these ten items. After 140 days, the earliest information will begin to be overwritten by new information. The Audit Trail can be downloaded using the Mini-AT Link software (or MasterLink32).

The Audit trail items can be changed using Mini-AT Link software and changing Item Codes 258-261 and 229-234. Any Mini-AT item can be selected for the Audit Trail. Assigning"255" to items 229-234 will configure the instrument RAM memory to the four item configuration.

	Number of Days Available per download type	
Interval Selected (Item 202)	4 Item	10 Item
15 Minutes	65 Days	35 Days
30 Minutes	130 Days	70 Days
60 Minutes	260 Days	140 Days
24 Hours	6240 Days	3360 Days

Table 8
Number of Days Available for Audit Trail

Instrument Calibration

There are two methods to calibrate the gas pressure and gas temperature transducers in the Mini-AT. The first method requires the use of a computer and Mini-AT Link (or MasterLink32) software. The second method requires the use of the Mercor Mini Field Calibrator. Both methods require a known value of the applied pressure and/or temperature as a reference.

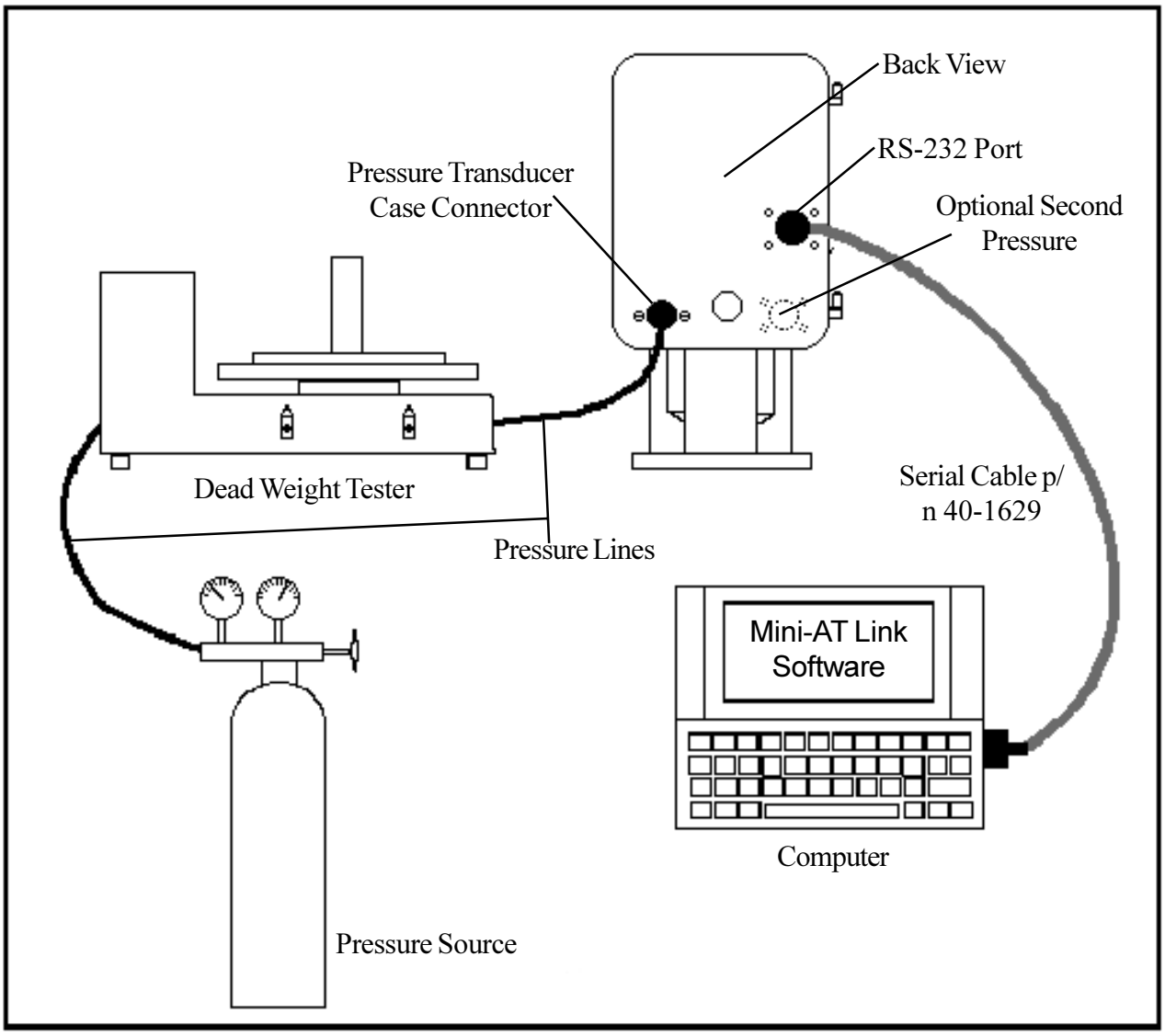


Fig. 19
2-Point Pressure Calibration

2-Point Pressure Calibration (Defined)

A 2-Point pressure calibration requires two different pressures be applied to the instrument's pressure transducer and be sampled by the data acquisition circuits. A low pressure value, usually 0.0 PSI, is applied to determine the Pressure Zero Calibration (offset). A higher pressure value is applied to determine the Pressure Span Calibration (gain). The default Calibration Parameters require that the Span Pressure exceed the Zero Pressure by at least 50% of the transducer range, otherwise a "Points Too Close" error message is displayed.

To produce a linear pressure response for all rated pressures and temperatures, each transducer has been factory characterized for ambient temperature effects. The characterization process determines the proper compensation coefficients for each transducer. The 2-point calibration process uses the coefficients when calculating the pressure offset and pressure span values. Once these two points have been calculated and stored in the instrument's memory, all other applied pressures are automatically linearized and temperature compensated by the coefficients.

2-Point Pressure Calibration Procedure (Gauge Transducers)

2-Point Pressure Calibration (Items Required)

- Mini-AT
- Pressure Source and fittings (capable of providing pressures of at least 50% of the Mini's pressure transducer range)
- Pressure Reference (accuracy to equal or exceed the accuracy of the Mini-AT's pressure system)
- Computer (IBM Compatible)
- Mini-AT Link Software (or MasterLink32)
- I/O cable, p/n 40-1629

2-Point Pressure Calibration (Procedure)

Make certain that the Pressure Compensation Coefficient listed in item codes 301 through 332 (341 through 372 for PLog) are for the pressure transducer installed. Also verify that Item Code 087 (or 408) is the desired pressure unit. Item Code 138 (or 411) matched the transducer serial number label and Item Code 112 (or 407) is set for **Gauge** type transducer. Refer to figure 19 when pressure calibrating the Mini-AT. Since the two-point calibration is mostly a software function, references to the appropriate sections in the Mini-AT Link (and MasterLink32) software are included.

1) Connect the pressure source and pressure reference to the selected Mini-AT pressure connector. (PCor or Plog)
2) Using serial cable p/n 40-1629, connect from the computer's serial port to the Mini-AT's RS-232 port.
3) Start Mini-AT Link software (or MasterLink32) on the computer.
4) Enter the access code for Level 1 or Level 2 when requested. The default Level 1 Access Code is 11111, the default Level 2 Access Code is 22222.
5) Select "Calibrate" from the main menu.
6) Select "PCor Pressure Calibration" or "PLog Pressure Calibration" from the sub-menu. Note: In MasterLink32 first select "Pressure" then a box will appear for selecting PCor or PLog.
7) If a communications link has not yet been established, the software will attempt to link to the Mini-AT. If the access code of the Mini-AT is not the default of '33333', a box will appear requesting the user to input the Instrument Access Code. Enter the access code when this box appears.

8) With zero pressure applied to the selected pressure transducer, perform the "Pressure Zero Calibration". The pressure displayed in green on the computer's screen is a live reading. This permits the user to determine if the pressure has stabilized so that a sample may be obtained. Click the "**Average Pressure Now**" button when it becomes active (text changes from gray to black) to obtain a sample of the applied pressure.
9) When the software displays the "Average Pressure", the value should be changed to match the pressure reference by clicking the "**Change**" button when it becomes active. Enter the pressure value for the zero reference pressure (usually 0.0) and then click **"OK"**. The Mini-AT will calculate the required difference (offset), store this calculated value at Item Code 017 (or 414), display the new value for item 017 (or 414) and the previous value at item 018 (or 415), before returning to a live pressure reading.
10) Compare the displayed pressure to the reference pressure. If the Mini-AT's pressure reading is not acceptable, click the "**Average Pressure Now**" button again to obtain another pressure sample. The program will continue to loop back to the live pressure reading. Obtain as many pressure samples as necessary until an acceptable pressure reading is displayed.
11) If the Mini-AT's zero pressure reading is acceptable, click the "**Span**" button to change to the Span Calibration sequence.
12) The screen title should have changed to; "Pressure Span Calibration". At this point, the software is waiting to sample the applied pressure that exceeds the zero reference pressure by at least 50% of the rated pressure transducer range. Increase the pressure applied to the Mini-AT to the span reference pressure.

    Example #1; If the zero reference pressure on a 100 PSI transducer equals 0.0 PSI, then the span reference pressure must be between 50.00 and 100.00 PSI.

    Example #2; If the zero reference pressure on a 600 PSI transducer equals 0.0 PSI, then the span reference pressure must be between 300.00 and 600.00 PSI.

13) The span calibration also displays a live pressure reading to allow the user to determine if the span reference pressure has stabilized. When the pressure has stabilized, click the "**Average Pressure Now**" button when it becomes active to obtain a pressure sample.
14) If the average pressure reading is not equal to the span reference pressure, click the "**Change**" button when it becomes active. Enter the pressure value for the span reference pressure and then click **"OK"**. As the computer screen updates, the Mini-AT will calculate the required span (gain), store this calculated value at Item Code 020 (or 417), display the new values for items 017 (414) and 020 (417), display the previous values at items 018 (415) and 021 (418) before returning to a live pressure reading. Obtain as many pressure samples as necessary until an acceptable span pressure reading is displayed.
15) Compare the average pressure reading to the span reference pressure. If the average pressure reading is acceptable, the pressure calibration process is complete. As a suggestion, recheck the pressure zero reading and any number of pressure points within the transducer range, or click **"Done"** to exit the calibration sequence.

2-Point Pressure Calibration (Absolute Transducers)

2-Point Pressure Calibration (Items Required)

- Mini-AT
- Pressure Source and fittings (capable of providing pressures of at least 50% of the Mini-AT's pressure transducer range)
- Pressure Reference (accuracy to equal or exceed the accuracy or the Mini-AT's pressure system)
- Computer (IBM Compatible)
- Mini-AT Link Software (or MasterLink32)
- I/O cable, p/n 40-1629
- Barometer

2-Point Pressure Calibration Procedure (Absolute Transducers)

Make certain that the Pressure Compensation Coefficient listed in item codes 301 through 332 (341 through 372 for PLog) are for the pressure transducer installed. Also verify that Item Code 087 (or 408) is the desired pressure unit. Item Code 138 (or 411) matched the transducer serial number label and Item Code 112 (or 407) is set for **Absolute** type transducer. Refer to figure 19 when pressure calibrating the Mini-AT. Since the two-point calibration is mostly a software function, references to the appropriate sections in the Mini-AT Link (and MasterLink32) software are included.

1) Connect a pressure source and pressure reference to the selected Mini-AT pressure connector. (PCor or PLog)
2) Using serial cable p/n 40-1629, connect from the computer's serial port to the Mini-AT's RS-232 port.
3) Start Mini-AT Link (or MasterLink32) software on the computer.
4) Enter the access code for Level 1 or Level 2 when requested. The default Level 1 Access Code is 11111, the default Level 2 Access Code is 22222.
5) Select "Calibrate" from the main menu.
6) Select "PCor Pressure Calibration" or "PLog Pressure Calibration" from the sub-menu. Note: In MasterLink32 first select "Pressure" then a box will appear for selecting PCor or PLog.
7) If a communications link has not yet been established, the software will attempt to link to the Mini-AT. If the access code of the Mini-AT is not the default of '33333', a box will appear requesting the user to input the Instrument Access Code. Enter the access code when this box appears.
8) With zero pressure applied to the selected pressure transducer, perform the "Pressure Zero Calibration". The pressure displayed in green on the computer's screen is a live reading. This permits the user to determine if the pressure has stabilized so that a sample may be obtained. Click the "**Average Pressure Now**" button when it becomes active (text changes from gray to black) to obtain a sample of the applied pressure.
9) Obtain the current local atmospheric pressure reading using a barometer or by some other means. When Mini-AT Link displays the absolute "Average Pressure", the value should be changed to match the current atmospheric pressure reading by clicking the "**Change**" button when it becomes active. Enter the current atmospheric pressure value and then click **"OK"**, making sure the units are comparable, i.e. PSIA. The Mini-AT will calculate the required difference (offset), store this calculated value at Item Code 017 (or 414), display the new value for item 017 (414) and the previous value at item 018 (or 415), before returning to a live, absolute pressure reading.
10) Compare the displayed pressure to the atmospheric pressure. If the Mini-AT's absolute pressure reading is not acceptable, click the "**Average Pressure Now**" button again to obtain another pressure sample. The program will continue to loop back to the live pressure reading. Obtain as many pressure samples as necessary until an acceptable pressure reading is displayed.

11) If the Mini-AT's absolute pressure reading is acceptable, click the "**Span**" button to change to the Span Calibration sequence.
12) The screen title should have changed to; "Pressure Span Calibration". At this point, the software is waiting to sample the applied pressure that exceeds the zero reference pressure by at least 50% of the rated pressure transducer range. Increase the pressure applied to the Mini-AT to the span reference pressure.

Example #1; If the zero reference pressure on a 100 PSIA transducer equals 14.73 PSIA, then the span reference pressure must be between 64.73 and 100.00 PSI.

Example #2; If the zero reference pressure on a 100 PSIA transducer equals 13.25 PSIA, then the span reference pressure must be between 63.25 and 100.00 PSI.

Example #3; If the zero reference pressure on a 600 PSIA transducer equals 14.73 PSIA, then the span reference pressure must be between 314.73 and 600.00 PSI.

13) The span calibration also displays a live pressure reading to allow the user to determine if the span reference pressure has stabilized. When the absolute pressure has stabilized, click the "**Average Pressure Now**" button when it becomes active to obtain a pressure sample. ***NOTE; The span reference pressure is equal to the sum of the dead weight tester pressure, plus the atmospheric pressure obtained in step 9 above.***
14) If the average absolute pressure reading is not equal to the sum of the reference pressure, plus the atmospheric pressure, click the "**Change**" button when it becomes active. Enter the pressure value for the span reference pressure (see NOTE i n step 13 above). As the computer screen updates, the Mini-AT will calculate the required span (gain), store this calculated value at Item Code 020, display the new values for items 017 (414) and 020 (417), display the previous values at items 018 (415) and 021 (418) before returning to a live pressure reading. Obtain as many pressure samples as necessary until an acceptable span pressure reading is displayed.
15) Compare the average absolute pressure reading to the span reference pressure. If the average absolute pressure reading is equal to the sum of the applied pressure plus the atmospheric pressure, the pressure calibration process is complete. As a suggestion, recheck the pressure zero reading and any number of pressure points within the transducer range, or click **"Done"** to exit the calibration sequence.

Single-Point Pressure Calibration (Defined)

A Single-Point Pressure Calibration allows the user to check and adjust any pressure reading, up to the transducer's maximum rated pressure. During a single-point calibration, the user compares the Mini-AT's live pressure reading to a reference pressure. More than one pressure reading may be compared, i.e., zero pressure and line pressure are two convenient pressures to check. If the two pressure readings agree, the instrument is assumed to be calibrated. If both pressure values do not match, the Mini-AT's pressure reading may be adjusted until it agrees with the reference pressure.

The Mercor Mini Field Calibrator is used to make adjustments to the live pressure reading. (Live Pressure is a programmable feature of the Meter Reader List). While viewing the live pressure, press the UP or DOWN button will raise or lower the pressure reading respectively. Pressing and holding down either button will fast-scroll the reading. Pressing and quickly releasing either the UP or DOWN button will change the pressure by 0.01 PSI. The new pressure reading is 'locked-in' when the ENTER button is pressed. If the ENTER button is not pressed, no change will take place and the field calibrator can be removed without any change to the calibration.

When the ENTER button is pressed, the microprocessor will recalculate a new Pressure Zero parameter and update Item Code 017 (414 for PLog) to the new value as described in step 9 of the 2-point calibration. This *digital* calibration has advantages over analog calibration techniques since the characterization coefficients are included in the recalculation, and the transducer's zero offset (item 017, 414) is stored in memory for future reference.

There are several points that need to be understood when using the single-point calibration method;

1) Attempt a single-point calibration only after the initial factory calibration or a subsequent 2-point calibration. It is necessary to establish valid P-Zero and P-Span parameters before hand.

2) Once the P-Span value for a given transducer is determined, this value will vary only slightly, if at all, during the functional life of the transducer. Exceptions are if the transducer is damaged or significantly overpressured.

3) Any and all pressure readings within the transducer's range may be viewed and adjusted. The adjustments made with the Field Calibrator ***are not*** limited by the Excess Change value at item 024.

4) When any live pressure reading is adjusted using the field calibrator, the amount of change (offset) is applied to all readings within the transducer's pressure range.

5) If two live pressure readings (preferably separated by at least 50% of the transducer range) compare to a reference pressure, the Mini-AT's pressure system can be considered calibrated.

6) If one or several live pressure checks do not compare to the reference pressure;
   a) Make certain the reference pressure is accurate.
   b) Calibrate the instrument's pressure system using the Single-Point Calibration method if an offset adjustment is adequate.
   c) Calibrate the instrument's pressure system using the 2-Point Calibration method if a span error must be corrected.

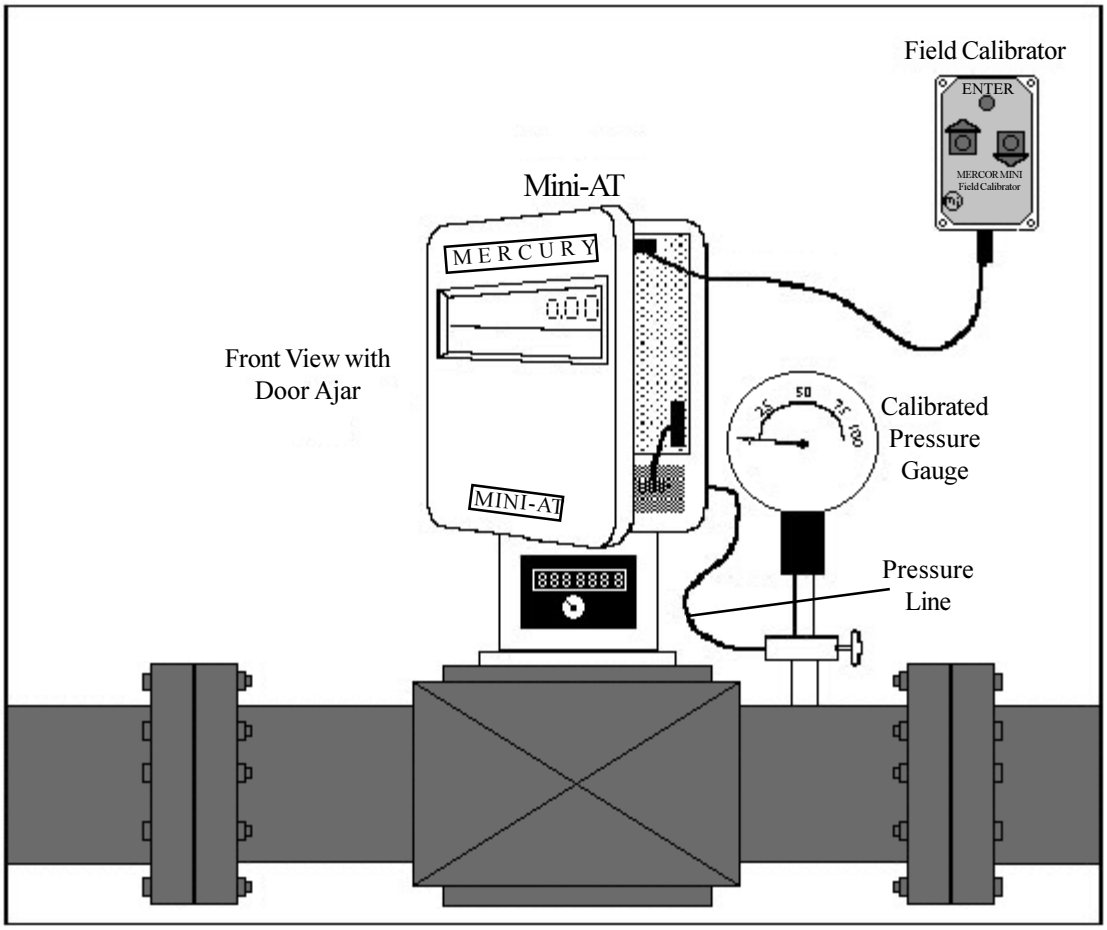


Fig. 20
Single Point Pressure Calibration

Single-Point Pressure Calibration (Items Required)

- Mini-AT
- Mercor Mini Field Calibrator, p/n 20-8360
- Pressure Source with fittings
- Calibrated pressure gauge, or equivalent
- Mag Wand, p/n 20-7286

Single-Point Pressure Calibration (Procedure)

Refer to figure 20 during the single-point calibration procedure. Before starting the procedure, unlock and open the Mini-AT's door. Locate connector J2 near the top center of the main circuit board. Connect a calibrated pressure gauge to the same pressure source that supplies pressure to the Mini-AT's pressure transducer. Note: If the Mini-AT is a dual pressure model, make sure to verify if using the PCor (P1) or PLog (P2) Transducer.

1) Plug the Mercor Mini Field Calibrator cable onto the main circuit board connector J2. Make certain all six pins are fully inserted into the black plastic cable connector. The cable connector is angled to prevent the connector from being plugged in upside-down.

2) If only a single, line-pressure check is all that is to be attempted, proceed to step 4, then directly to step 9.
3) Remove pressure from the selected pressure transducer.
4) Use a mag wand to scroll to the Live Pressure display (PCor or PLog) of the Meter Reader List.
5) Verify that the Mini-AT's live pressure reading displays 0.00 PSI +/- 0.25% of full scale.
6) If the pressure reading is within tolerance, proceed to step 9.
7) If the Mini-AT's displayed pressure reading is greater than 0.00, press the DOWN button on the Mercor Mini Field Calibrator until it reads 0.00. If the Mini-AT's displayed pressure reads negative (ex. -0.05), press the UP button until it reads 0.00.
8) Press the ENTER button to 'lock-in' the pressure reading. Note; The Mini-AT's LCD will go blank for a second while the instrument is computing the new P-Zero value. When completed, the LCD will return to a live pressure display and further adjustments are possible, if needed.
9) Apply line pressure to the Mini-AT's transducer. Compare the live pressure display to the pressure reading on the calibrated pressure gauge. If the two readings are within tolerance, no further adjustments are needed, proceed to step 11.
10) If the two readings are outside an acceptable tolerance, consider the most appropriate action listed in item 6 of **Single-Point Pressure Calibration (Defined)** .
11) Use the mag wand to return the instrument to the Corrector Mode.
12) Unplug the Field Calibrator cable from the main board connection J2.

The above procedure compared the Mini-AT's live pressure to the pressure on a calibrated pressure gauge at two different pressure points. An alternative would be to check the pressure at line pressure only. If the readings are within tolerance, the pressure calibration could be assumed to be sufficient. However, any of the above procedures should be subject to individual gas company policies.

2-Point Temperature Calibration (Defined)

A 2-Point temperature calibration requires that two different temperatures be applied to the instrument's temperature probe and be sampled by the data acquisition circuits. A low temperature source, usually an ice bath (32 degrees F) is used to determine the Temperature Zero Calibration. A higher temperature source is used to determine the Temperature Span Calibration (gain). The default Calibration Parameters require the Span Temperature exceed the Zero Temperature by at least 10% of the instrument's temperature range.

The temperature probe provides a nonlinear, but very predictable temperature response for all rated temperatures. The instrument's firmware contains the required information to produce a linear temperature response for any connected temperature probe. The 2-point calibration process uses the temperature offset and temperature span values to adjust for individual sensor variations. Once these two points have been calculated and stored into memory, all other applied temperatures can be determined by a linear interpolation.

2-Point Temperature Calibration (Items Required)

- Mini-AT
- A cold temperature source (ice bath)
- A hot temperature source (heated water, not to exceed 170 degrees F.)
- Temperature Reference (calibrated thermometer)
- Computer (IBM Compatible)
- Mini-AT Link (or MasterLink32) Software
- I/O cable, p/n 40-1629

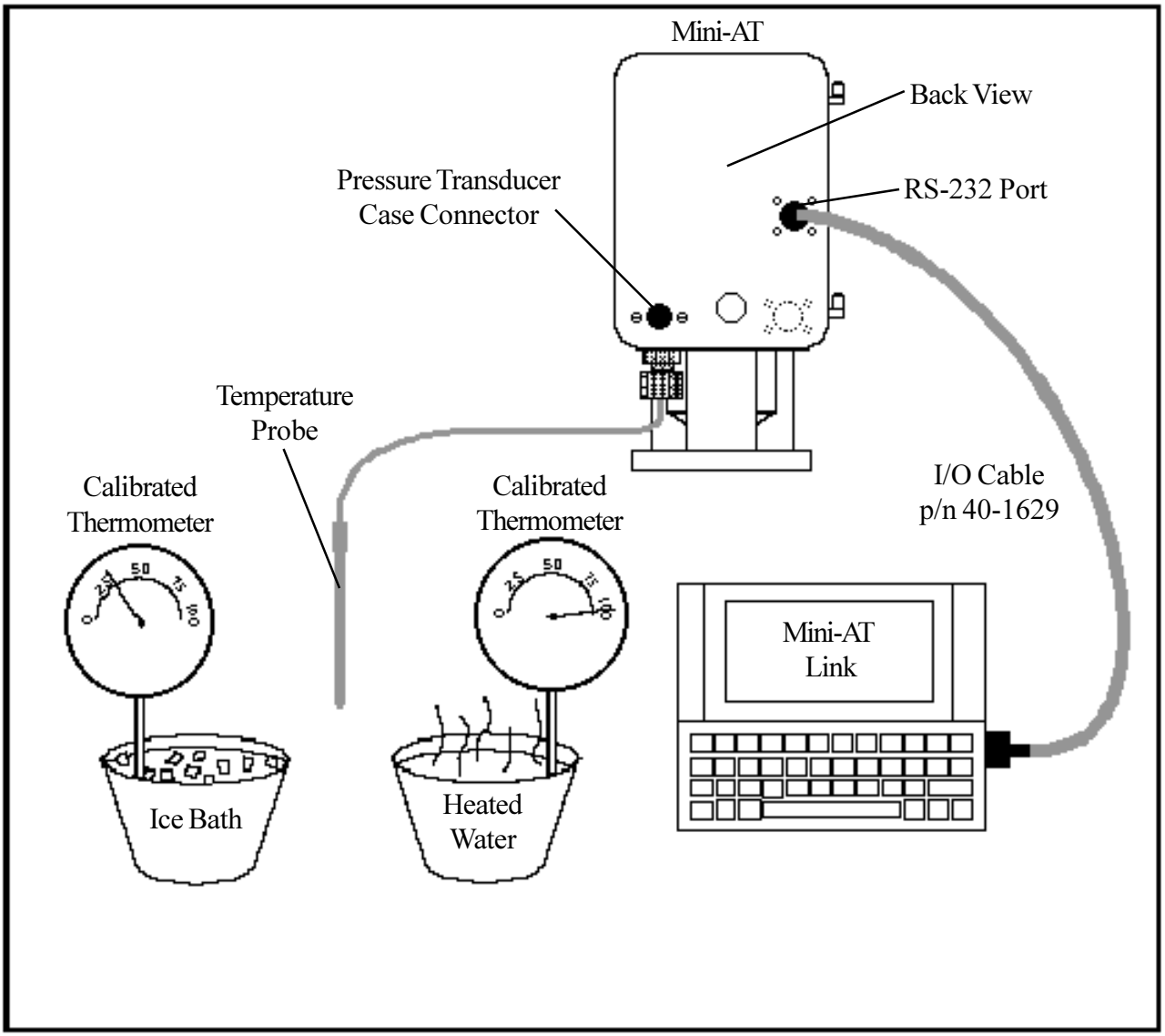


Fig. 21
2-Point Temperature Calibration

2-Point Temperature Calibration (Procedure)

Refer to figure 21 when temperature calibrating the Mini-AT. Since the two-point calibration is mostly a software function, references to the appropriate sections in the Mini-AT Link software are included.

1) Prepare an agitated ice bath and a container of heated water.
2) Using serial cable p/n 40-1629, connect from the computer's serial port to the Mini-AT's RS-232 port.

3) Start Mini-AT Link software on the computer.
4) Enter the access code for Level 1 or Level 2 when requested. The default Level 1 Access Code is 11111, the default Level 2 Access Code is 22222.
5) If a communications link has not yet been established, the screen will display a box requesting the user to input the Instrument Access Code. Enter the access code when this box appears, the default code is 33333.
6) Select "Calibrate" from the main menu.
7) Select "Temperature Calibration" from the sub-menu.
8) With the tip of the temperature probe lowered into the ice bath, perform the "Temperature Zero Calibration". The temperature displayed in green on the computer's screen is a live reading. This permits the user to determine if the temperature has stabilized so that a sample may be obtained. Click the "**Average Temperature Now**" button when it becomes active (text changes from gray to black) to obtain a sample of the temperature.
9) When Mini-AT Link displays the "Average Temperature", the value should be changed to match the reading of the calibrated thermometer by clicking the "**Change**" button when it becomes active. Enter the temperature value for the zero reference temperature (usually 32 degrees F) and then click "OK". The Mini-AT will calculate the required difference (offset), store this calculated value at Item Code 035, display the new value for item 035 and the previous value at item 036, before returning to a live temperature reading.
10) Compare the displayed temperature to the reference temperature. If the Mini-AT's temperature reading is not acceptable, click the "**Average Temperature Now**" button again to obtain another temperature sample. The program will continue to loop back to the live temperature reading. Obtain as many temperature samples as necessary until an acceptable temperature reading is displayed.
11) If the Mini-AT's zero temperature reading is acceptable, click the "**Span**" button to change to the Span Calibration sequence.
12) The screen title should have changed to; "Temperature Span Calibration". At this point, the software is waiting to sample a temperature that exceeds the zero reference temperature by at least 10% of the instruments's temperature range, i.e. a temperature greater than 53.0 degrees F. Insert the temperature probe into the container of heated water.
13) The span calibration also displays a live temperature reading to allow the user to determine if the span reference temperature has stabilized. When the temperature has stabilized, click the "**Average Temperature Now**" button when it becomes active to obtain a temperature sample.
14) If the average temperature reading is not equal to the span reference temperature, click the "**Change**" button when it becomes active. Enter the temperature value from the thermometer in the heated-water bath and then click **"OK"**. As the computer screen updates, the Mini-AT will calculate the required span (gain), store this calculated value at Item Code 038, display the new values for items 035 and 038, display the previous values at items 036 and 039 before returning to a live temperature reading. Obtain as many temperature samples as necessary until an acceptable span temperature reading is displayed.
15) Compare the average temperature reading to the span reference temperature. If the average temperature reading is acceptable, the temperature calibration process is complete. As a suggestion, recheck the temperature zero reading and any number of temperature points within the transducer range, or click **"Done"** to exit the calibration sequence.

Single-Point Temperature Calibration (Defined)

A Single-Point Temperature Calibration allows the user to check and adjust any temperature reading, up to the instrument's maximum rated temperature (170 F.). During a single-point calibration, the user compares the Mini-AT's live temperature reading to a reference temperature. More than one temperature reading may be compared, i.e. an ice bath and line temperature are two convenient temperatures to check. If the two temperature readings agree, the instrument is assumed to be calibrated. If the two temperature values are different, the Mini-AT's temperature reading may be adjusted until it agrees with the reference temperature.

The Mercor Mini Field Calibrator is used to make adjustments to the live temperature reading during the single-point calibration. While viewing the live temperature display, pressing the UP or DOWN buttons will raise or lower the temperature reading respectively. Pressing and holding down either button will scroll the reading. Pressing and quickly releasing either the UP or DOWN button will change the temperature by 0.01 degrees. The new temperature reading is 'locked-in' when the ENTER button is pressed. If the ENTER button is not pressed, no change will take place and the field calibrator can be removed without any change to the calibration.

When the ENTER button is pressed, the microprocessor will recalculate a new Temperature Zero parameter and update Item Code 035 to the new value as described in step 9 of the 2-point calibration. This *digital* calibration technique has advantages over an analog calibration since the linearization information is included in the recalculation, and the transducer's zero offset (item 035) is stored in memory for future reference.

There are several points that need to be understood when using the single-point calibration method;

1) Attempt a single-point calibration only after the initial factory calibration or a subsequent 2-point calibration. It is necessary to establish a valid T-Zero and T-Span parameters beforehand.
2) Once the T-Span value for a given temperature probe is determined, this value will vary only slightly, if at all, during the functional life of the temperature probe.
3) Any and all temperature readings within the instrument's range may be viewed and adjusted. The adjustments made with the Field Calibrator ***are not*** limited by the Excess Change value at item 042.
4) When any live temperature reading is adjusted using the field calibrator, the amount of change (offset) is applied to the instrument's entire temperature range.
5) If two or more live temperature readings (preferably separated by at least 10% of the transducer range) compare to a reference temperature, the Mini-AT's temperature system can be considered calibrated.
6) If one or several live temperature checks do not compare to the reference temperature;
   a) Make certain the reference temperature is accurate.
   b) Calibrate the instrument's temperature system using the Single-Point Calibration method if an offset adjustment is adequate.
   c) Calibrate the instrument's temperature system using the 2-Point Calibration method if a span error must be corrected.

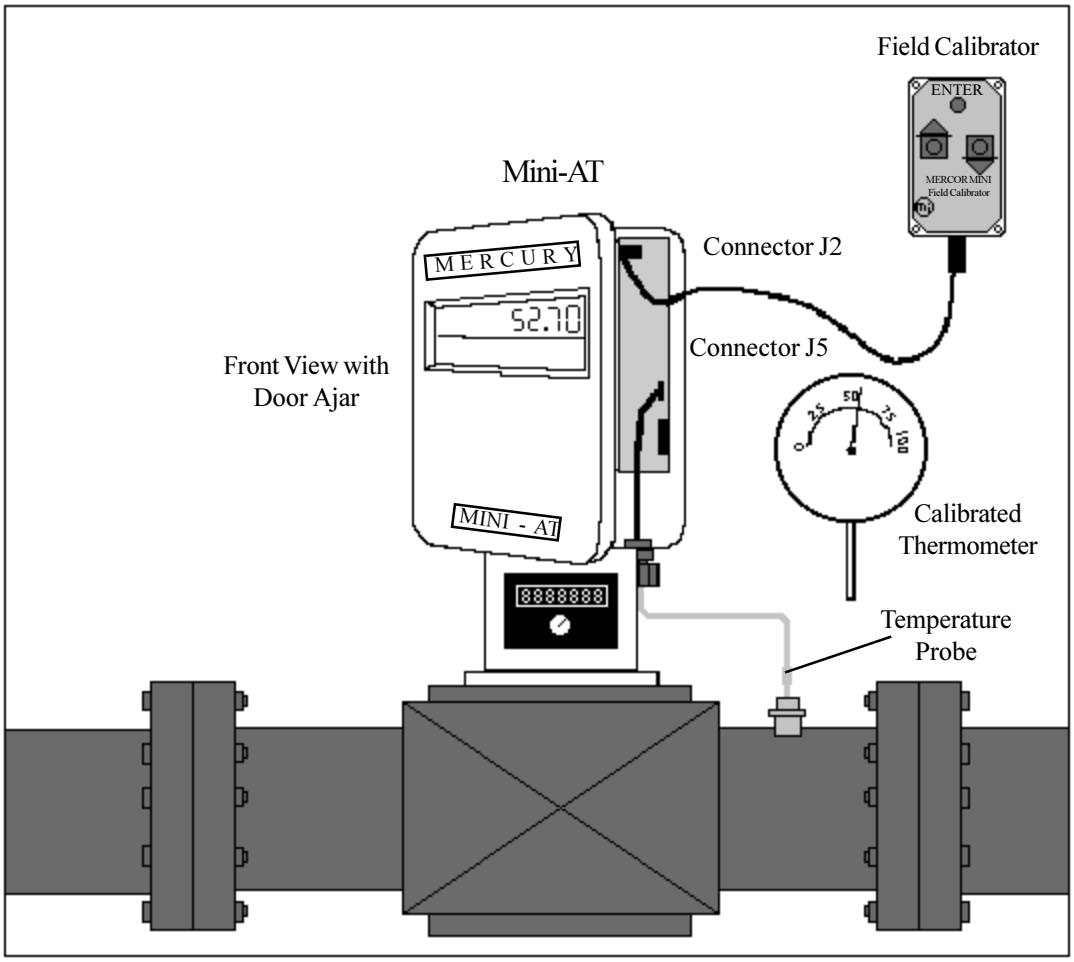


Fig. 22
Single-Point Temperature Calibration

Single-Point Temperature Calibration (Items Required)

- Mini-AT
- Mercor Mini Field Calibrator, p/n 20-8360
- Calibrated Thermometer
- Mag Wand, p/n 20-7286

Single-Point Temperature Calibration (Procedure)

Refer to figure 22 during the single-point calibration procedure. Before starting the procedure, unlock and open the Mini-AT's door. Locate connector J2 near the top center of the main circuit board.

1) Plug the Mercor Mini Field Calibrator cable onto the main circuit board connector J2. Make certain all six pins are fully inserted into the black plastic cable connector. The cable connector is angled to prevent the connector from being plugged in upside-down.
2) Use a mag wand to scroll to the Live Temperature display of the Meter Reader List.
3) While the temperature probe is inserted into the gas line's thermowell, record (write down) the Mini-AT's live temperature reading.
4) Remove the temperature probe from the thermowell and insert the stem of the calibrated thermometer into the thermowell.

5) After the temperature has stabilized, write down the temperature from the calibrated thermometer.
6) Reinstall the temperature probe into the thermowell and allow the temperature to stabilize.
7) Compare the Mini-AT's live temperature reading to the temperature from the calibrated thermometer. If the temperature readings are within tolerance, proceed to step 12.
8) If the Mini-AT's live temperature is greater than the calibrated thermometer's temperature, press the DOWN button on the Mercor Mini Field Calibrator until they agree. If the Mini-AT's live temperature is lower than the calibrated thermometer's temperature, press the UP button until they agree.
9) Press the ENTER button to 'lock-in' the temperature reading. Note; The Mini-AT's LCD will go blank for a second while the instrument is computing the new T-Zero value. When completed, the LCD will return to a live temperature display and further adjustments are possible, if needed.
10) If the two readings are within tolerance, no further adjustments are needed, proceed to step 12.
11) If the two readings are outside an acceptable tolerance, consider the most appropriate action listed in step 6 of **Single-Point Temperature Calibration (Defined)**.
12) Use the mag wand to return the instrument to the Corrector Mode.
13) Unplug the Field Calibrator cable from the main board connection J2.

The above procedure compared the Mini-AT's live temperature to the temperature of a calibrated thermometer. If the readings are within tolerance, the temperature calibration could be assumed sufficient. However, any of the above procedures should be subject to individual gas company policies.

Main Board Jumpers

The Mini-AT has several features and functions that are controlled by installing jumpers on header pins. Table 9 lists all main board jumpers with their factory default settings.

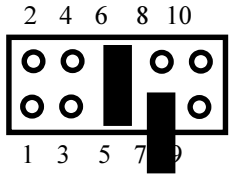
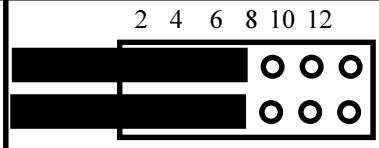
Jumper Name	Jumper Configuration (Default)	Default Purpose
JB24		1 2; LOADER not executed after reset, 3 4; Defaults not loaded after unconfigured 5-6; Flash Upgrades permitted 7-8; Serial access limited by the selection at items 139, 126 and 272 9 10; Prevent setting of Event Log Lock
JB29		1-2 (not 2-3) and 5-6 (not 6-7) Sets pulse width of KYa and KYb to 62.5 milliseconds. (Other pulse widths can be achieved by substituting shunt resistors)
JB30		1-3-5 and 2-4-6; Configures TB1 for 2 Form-A pulse channels, i.e., KYa and KYb. Note: 1-3-5-7-9-11 and 2-4-6-8-10-12; configures TB1 for a single Form-C channel
JB31		1-2; Selects input signal to pulse circuits as Form-A Note: 2-3; Selects input as Form-C
JB32		1 2; Current limiting resistor to input switch board is not bypassed.
JB900		2-3; Selects serial data for modem operation at TB2 Note:1-2; Selects Aux modem operation (J20)

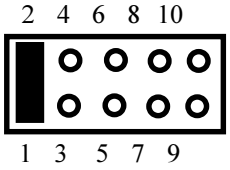
Table 9
Default Jumper Settings

Flash Access Override Jumper

Pins 1 & 2 of Jumper Block 24 (JB24) provide Flash Access Override. With a jumper across pins 1 & 2, the LOADER firmware is forced to execute after an instrument RESET. An instrument RESET is defined as: Unplugging the main and backup batteries from the main board (for at least 20-seconds) and then, plug-in both batteries. By default, the jumper is removed.

LOADER firmware is a computer program, resident in the Mini-AT's internal memory, for the sole purpose of allowing a user to upgrade the Mini-AT's application firmware. The LOADER firmware may also be upgraded when LOADER enhancements become available.

Note: The Mini-AT cannot return to the application firmware while this jumper is in place.

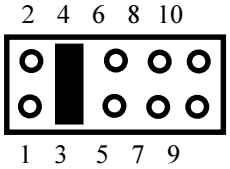


JB24
(with jumper on pins 1 & 2)

Force Factory Defaults Jumper

Pins 3 & 4 of Jumper Block 24 (JB24) provides a means to Force Factory Defaults. With a jumper across pins 3 & 4, the Mini-AT will be configured to factory defaults after an instrument RESET (Unconfigured). An instrument RESET is defined as: Unplugging the main and backup batteries from the main board (for at least 20-seconds) and then, plug-in both batteries. By default, the jumper is removed.

Note: During Force Factory Defaults, the status of Event Log Lock and the values for Transducer Coefficients and Transducer Serial Number items remain unchanged.



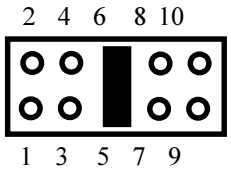
JB24
(with jumper on pins 3 & 4)

Flash Access Security Jumper

Mini-AT firmware (instrument operating instructions) is stored in flash memory Adding new features and capabilities to the instrument is simply a matter of uploading a file containing a newer version of firmware through the serial port connection. There are no EPROM chips to be removed or plugged into sockets.

Pins 5 & 6 of Jumper Block 24 (JB24) provides Flash Access Security. With a jumper across pins 5 & 6, the user is permitted to upload newer firmware into Flash Memory. If there is no jumper across pin 5 & 6, firmware upgrades will not be permitted. As a check, Item Code 268 can be read by Mini-AT Link to determine what jumpers are installed on JB24. By default, the jumper is installed.

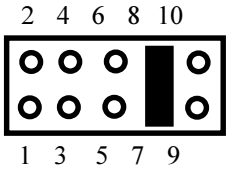
The serial connection for a firmware upgrade can be either the local serial port or via a modem. If the data is transferred via the local serial port, item 126 may be set to 38.4 Kbaud to achieve the faster possible transfer time. Conversely, if the transfer is via a modem, the transfer time will be noticeably longer for modems with carrier speeds less than 38.4 Kbaud.



JB24
(with jumper on pins 5 & 6)

Serial Access Security Jumper

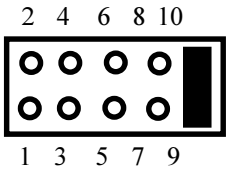
Pins 7 & 8 of Jumper Block 24 (JB24) provides Serial Access Security. If a jumper is across pins 7 & 8 when a serial connection is established, TWO WAY serial communications is allowed regardless of the setting at Item Code 139 (Serial Link Code). Also, with the jumper installed, the Instrument Baud Rate (item 126) and Modem Baud Rate (item 272) are forced to operate at 9600 baud. When the jumper across pins 7 & 8 is removed, the configuration of Item Codes 126, 139 and 272 are obeyed. By default, the jumper is removed.



JB24
(with jumper on pins 7 & 8)

Event Logger Lock Jumper

Pins 9 & 10 of Jumper Block 24 (JB24) provides a hardware requirement when attempting to lock the Event Logger through software. A jumper across pins 9 & 10 is required to allow host software to set the 'lock' condition for Item Code 149. By default, the jumper is removed.



JB24
(with jumper on pins 9 & 10)

Be sure to read and understand the restrictions involved before attempting to configure the Event Logger Lock. Once the Event Logger is 'Locked', the jumper may be permanently removed.

The function of the Event Logger is to record: Date, Time, UserID#, assigned Sequence Number, Before Value and After Value for changes made to instrument parameters. By default, the Event Logger is '**unlocked**', meaning old event records begin to be overwritten after 500 event changes. The Event Logger Lock is a feature that can **only** be enabled through software if a jumper is across pins 9 & 10 of JB24. Once enabled (Locked), the functionality of the Event Log conforms to Canadian regulations as specified by Measurement Canada.

Several key Canadian requirements include:

- Units shipped to Canada will be factory configured with the Event Logger 'Locked'.
- After the Event Logger Lock is selected, **the 'Lock' is permanent, i.e. it cannot be changed back to "Unlocked"**
- When the maximum number of event records stored in memory is reached (500), the Event Log information must be downloaded to a computer before any additional instrument changes are permitted
- Events records are automatically numbered sequentially starting at zero
- Only changes to instrument parameters that can affect "Billing" are recorded in the 'Locked' Event Logger, all other parameters are not recorded.

Firmware Reprogramming

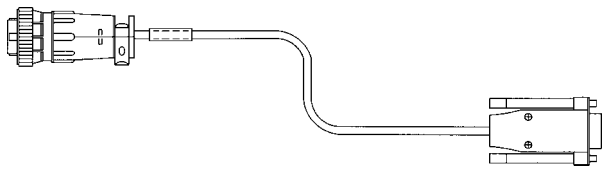
Mini-AT firmware (instrument operating program) is stored in flash memory. Adding new features and capabilities to the instrument is simply a matter of uploading a file containing a newer version of firmware through the serial port connection. There are no EPROM chips to be removed or plugged into sockets. Flash Access Security is provided by the use of a jumper selection at JB24 pins 5 and 6. To upgrade flash memory, use the software application Firmware Manager.

Items Required

- **PC** with Windows 95/98 OS (or higher)
- **Firmware Manager** software (FWUM) version 1.0502 or later

  Install Firmware Manager on your computer using the following steps:

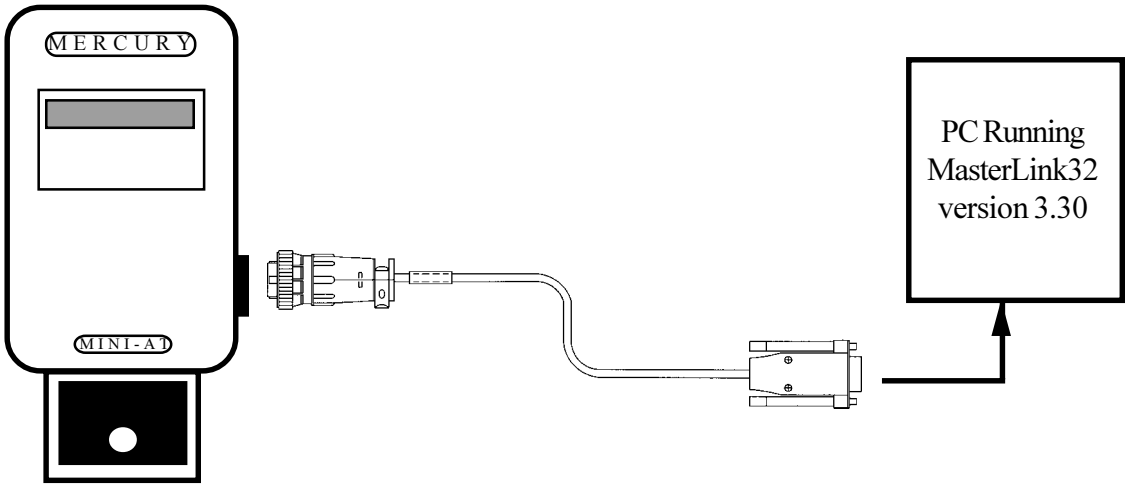
  - Insert the 3 1/2" floppy containing Firmware Upgrade Manager (disk #1) into your computer floppy drive.
  - Click the windows **Start** button and select **Run** from the Start Menu
  - In the run box, type in **A:\setup.exe**
  - The screen will display: "Firmware Manager Setup". At the bottom of the screen will be a dialogue box to choose the installation drive (default is C:\). Select the drive letter you wish to install to and press continue.
  - Setup will begin to install the files for Firmware Manager from disk #1. After disk #1 is complete, setup will prompt for disk #2. Insert disk #2 and continue the installation.
  - At the end of the installation, there will be a message stating that the installation is complete. At this point, setup will give you the option of restarting the computer to update the system. Select "Yes" to update the system and restart the computer.
- **MasterLink32** software version 3.30 or later
- **RS-232 serial I/O cable**, p/n 40-1629



- **Mini-AT Firmware file** (maxXXXXX.mmf or maxXXXXX.mmx)
- **Mini-AT Mainboard** (p/n 40-2335)

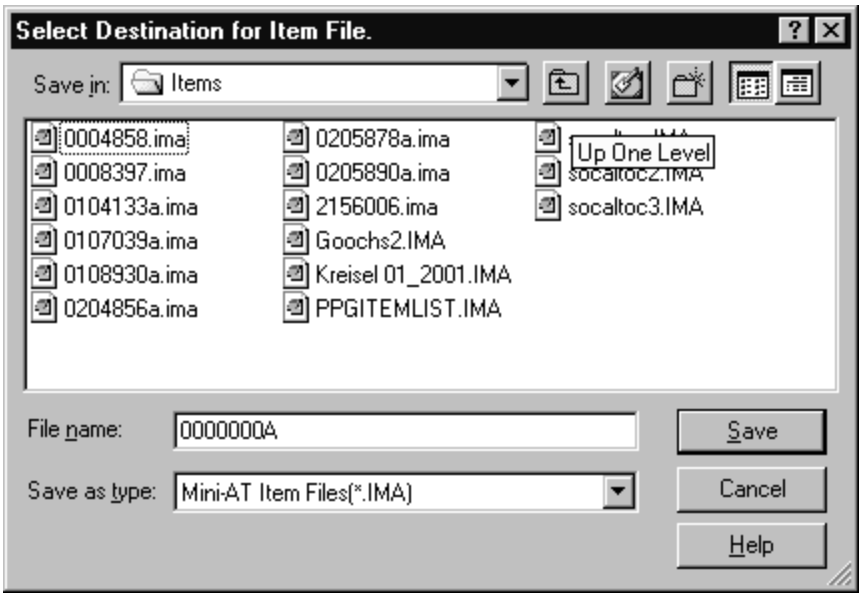
Before Upgrading Firmware (saving instrument data):

1. Open MasterLink32 software.
2. Connect the Serial Cable (40-1629) from round connector on the back of the Mini-AT to the computer COM port.

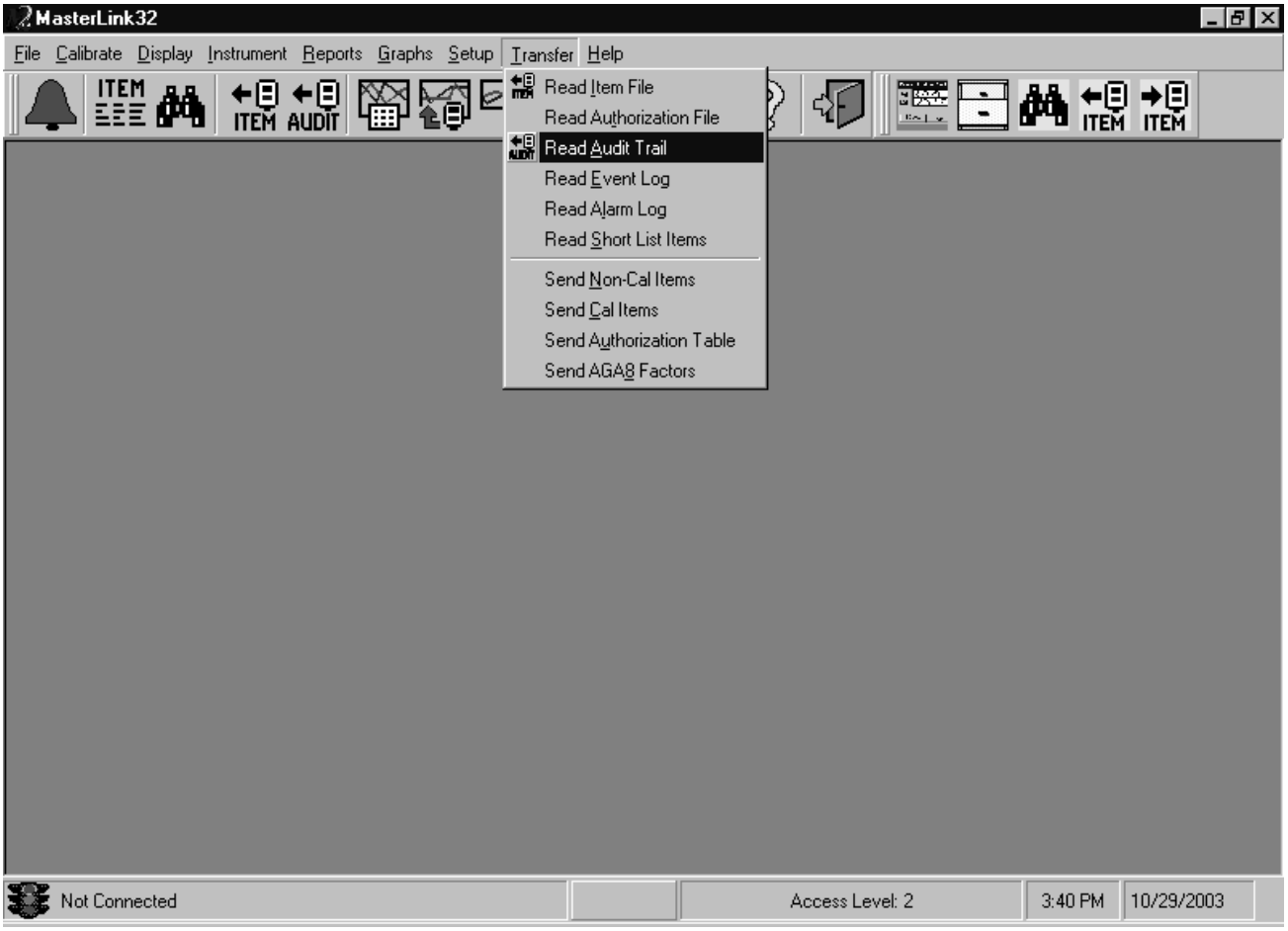


3. From the Transfer Menu, select Read Item File.

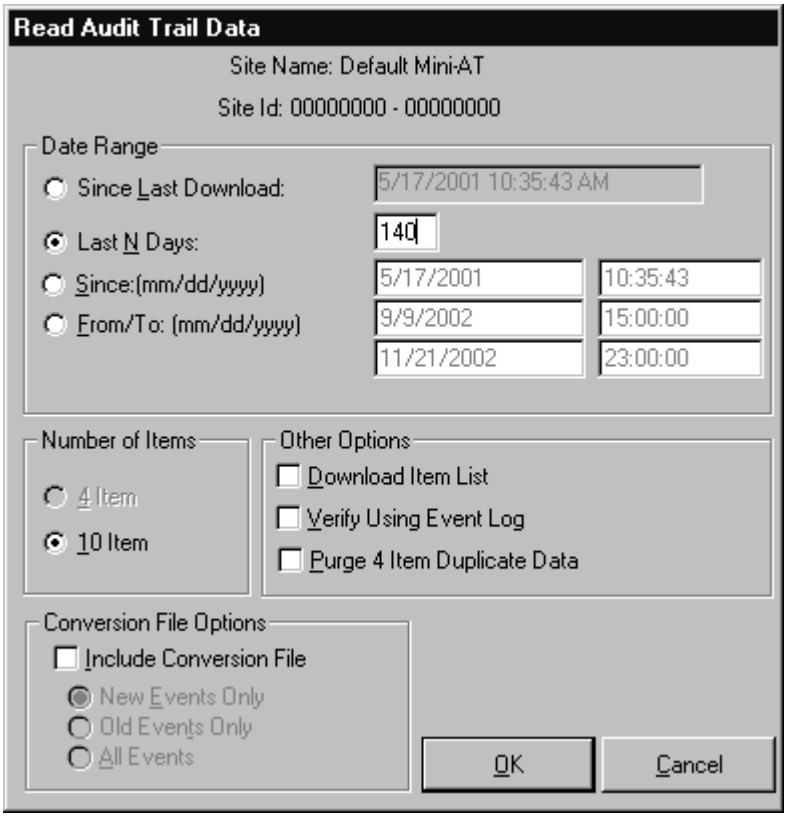
4. MasterLink will establish a link with the Mini-AT and display a dialogue box. Type in a name for the item file and click the Save button. MasterLink will then save all items to a file with the selected filename.



5. After the item file is downloaded, click OK and then select Read Audit Trail from the Transfer Menu



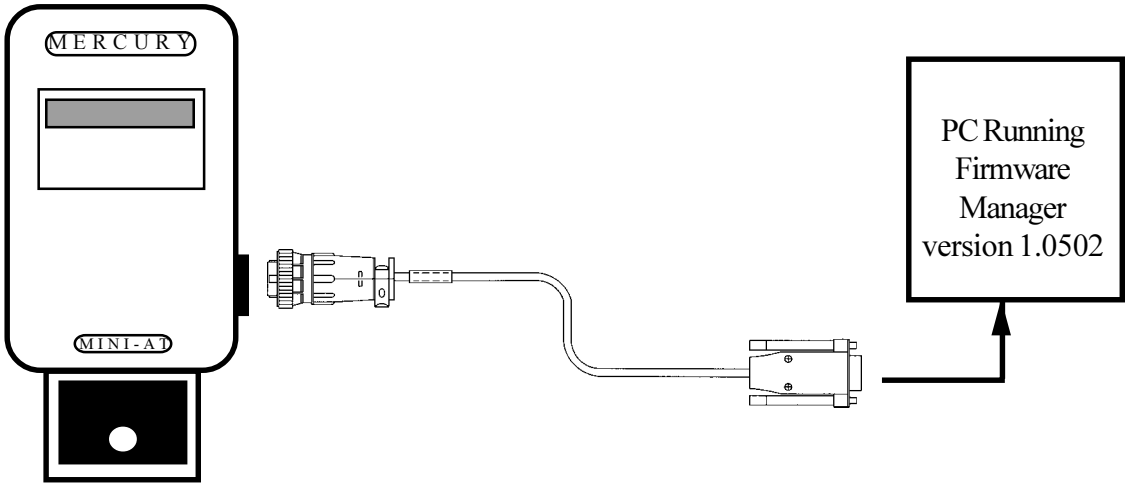
8. Select the Last N Days radio button from the option screen and type 140 into the blank Click OK and MasterLink will read the last 140 days of Audit Trail information from the Mini-AT.



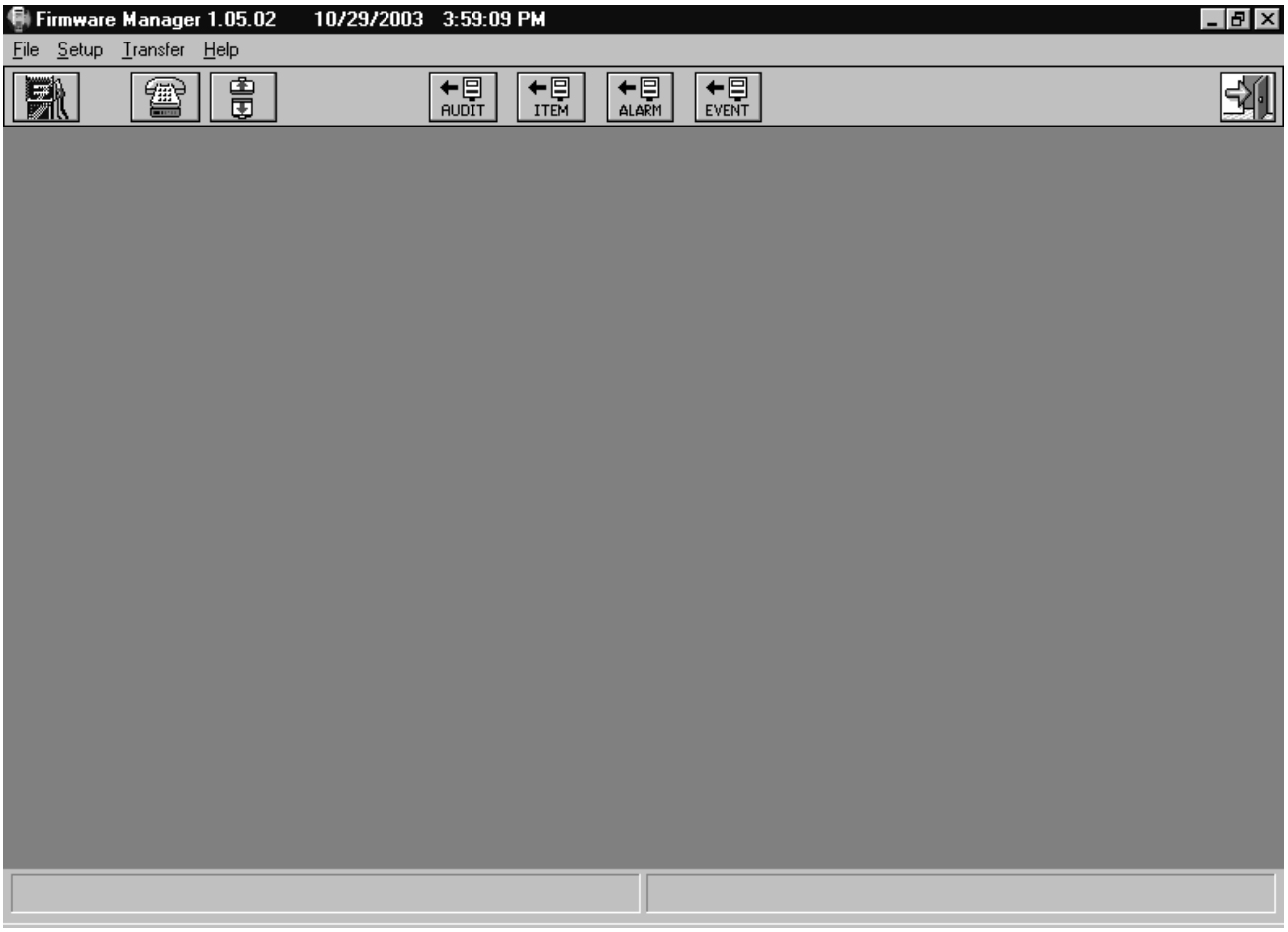
9. After the download is complete, disconnect the link and exit MasterLink32 software.

Procedure to upgrade Mini-AT firmware:

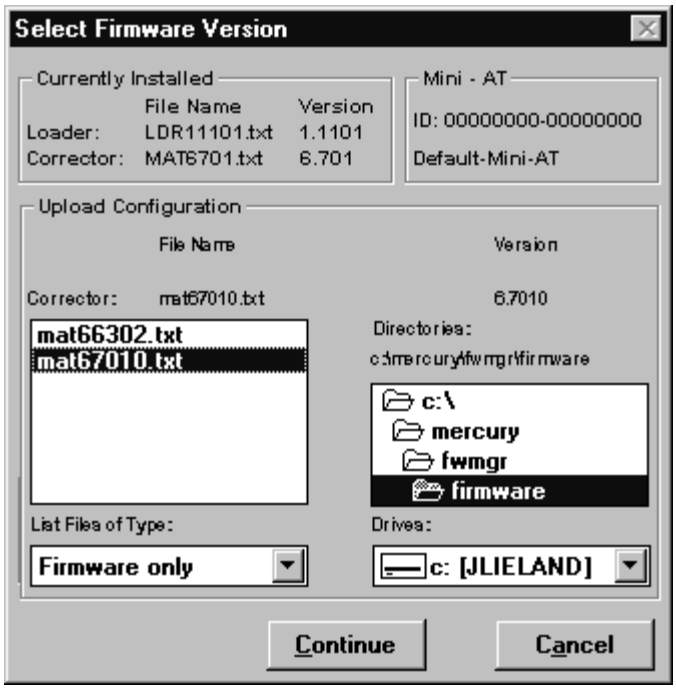
1. Connect the Serial Cable (40-1629) from the Mini-AT port to the computer COM port. Make Sure that pins 3 and 4 are jumpered on JB24. (See page 75 for more information.)



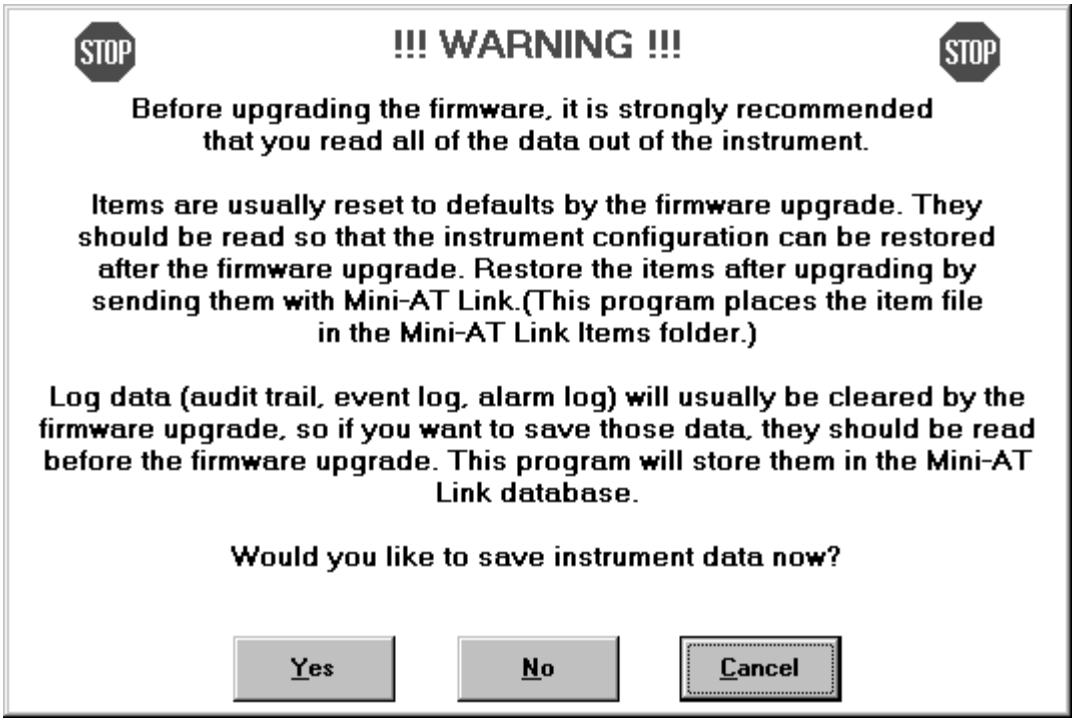
3. Open Firmware Manager by double clicking on the icon.
4. Select "Send Mini-AT Firmware" by clicking the gas pump button.



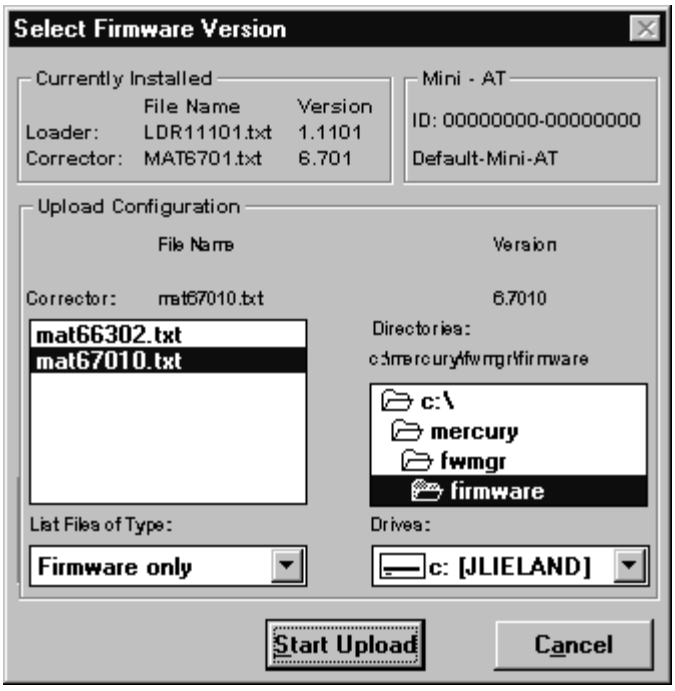
5. After clicking the gas pump button, a dialogue box will appear. Select the Mini-AT firmare file (matXXXXX.txt) and click continue.



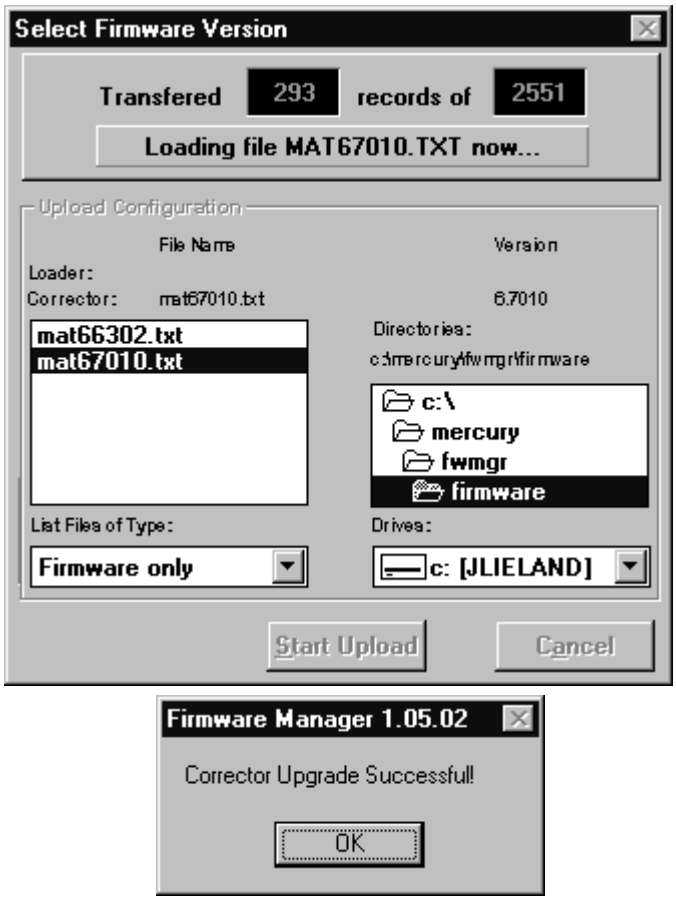
6. At this point the software will display a warning about downloading instrument data. Since this has already been completed in the pre-firmware upgrade procedure, press no to continue



7. The dialogue box from step 5 will reappear. Click Start Upload to begin sending the Mini-AT firmware.



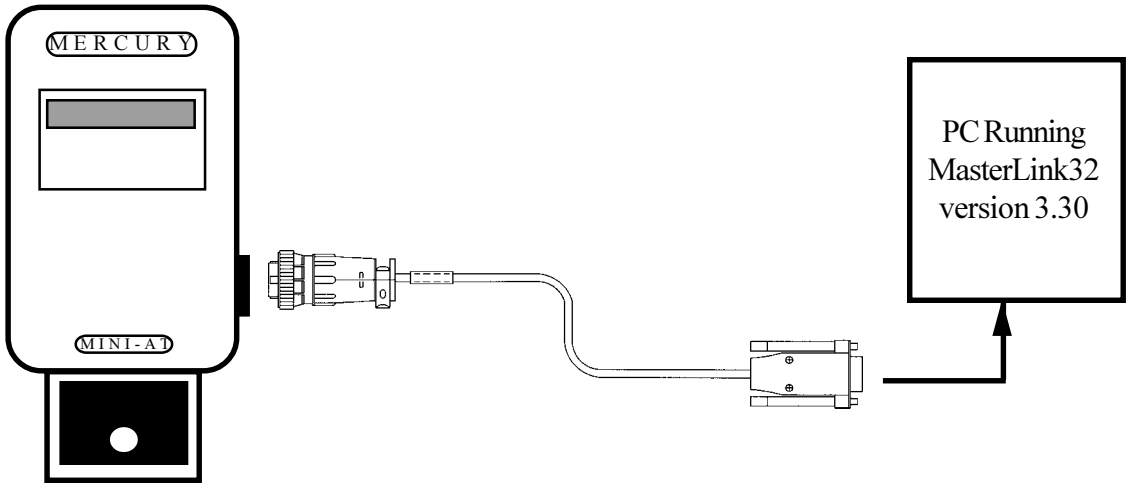
8. Firmware Manager will display the progress of the upload. When the upload is completed a new dialogue box will appear stating that the upgrade was successful. Click OK.



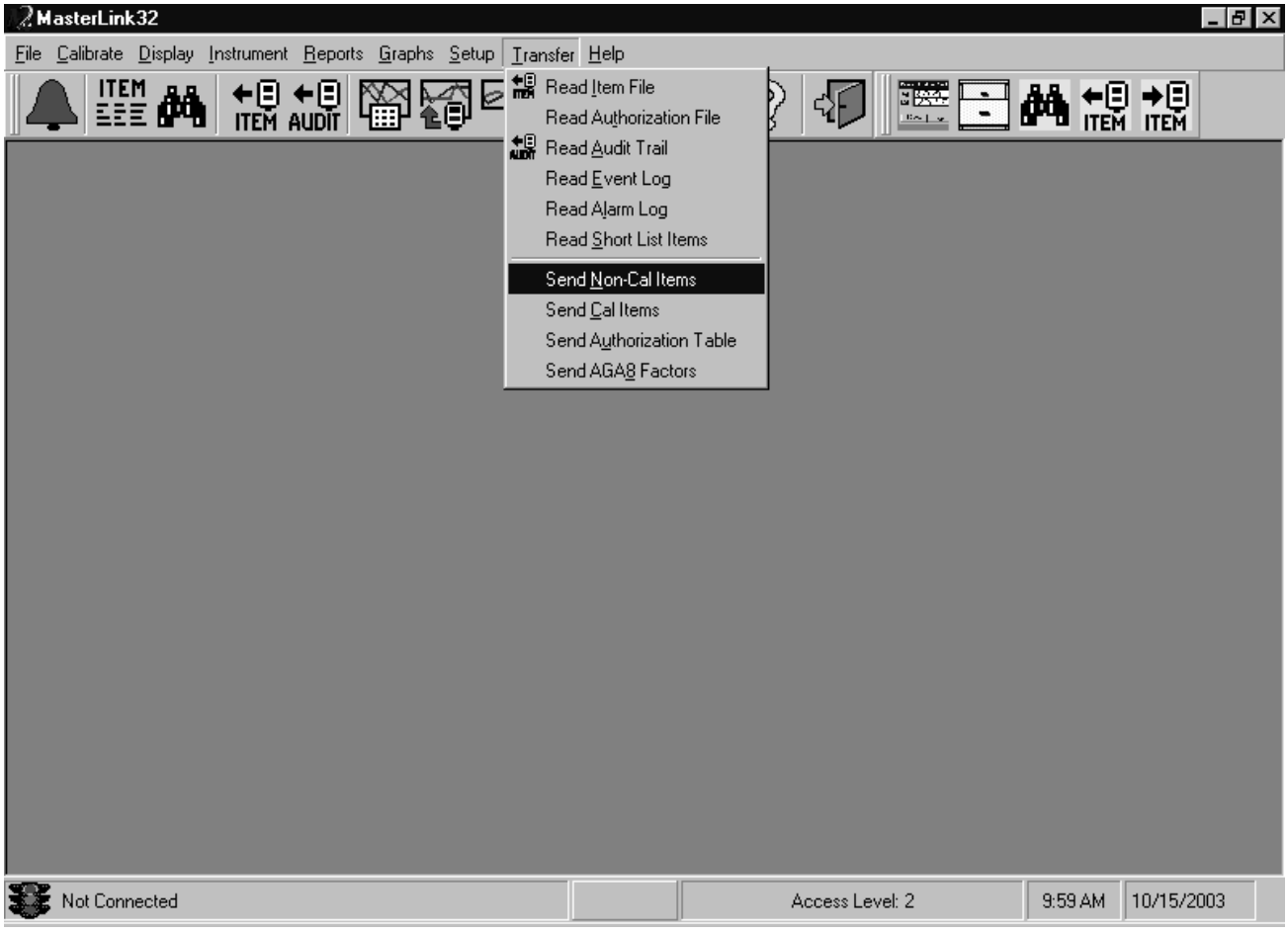
9. The firmware upgrade is now completed. Exit Firmware Manager and disconnect the Mini-AT from the computer

After Upgrading Firmware (restoring instrument configuration):

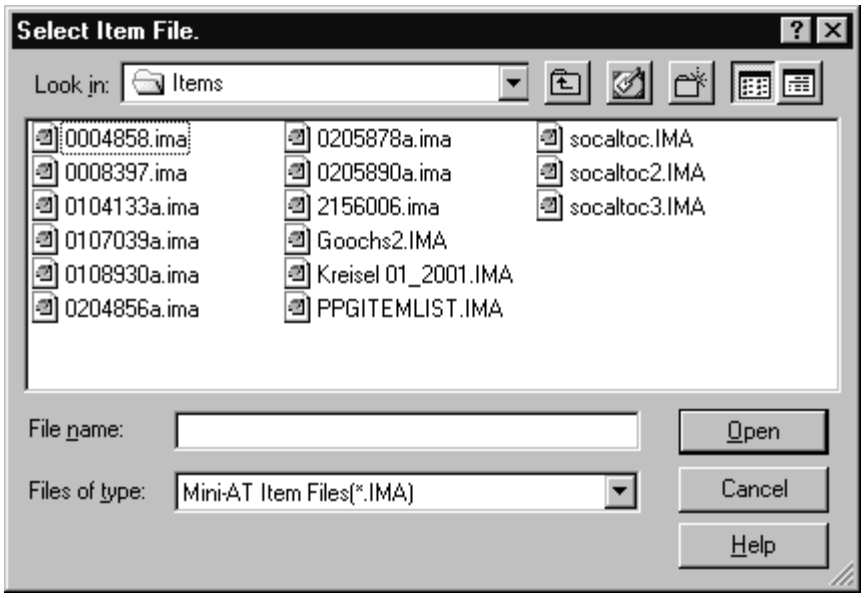
1. Open MasterLink32 software
2. Connect the Serial Cable (40-1629) from the Mini-AT port to the computer COM port.



4. From the Transfer Menu, select Send Non-Cal Items

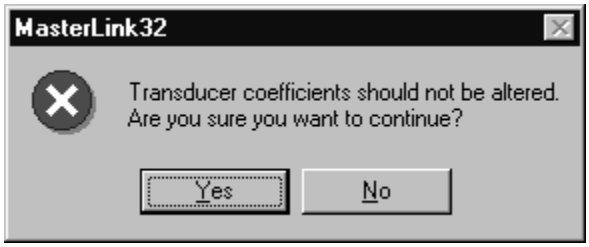


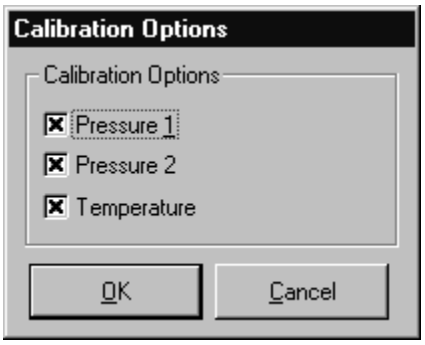
5. Select the Item File that was saved in step 4 of the Pre-Firmware upgrade procedure from the list and click the Open button.



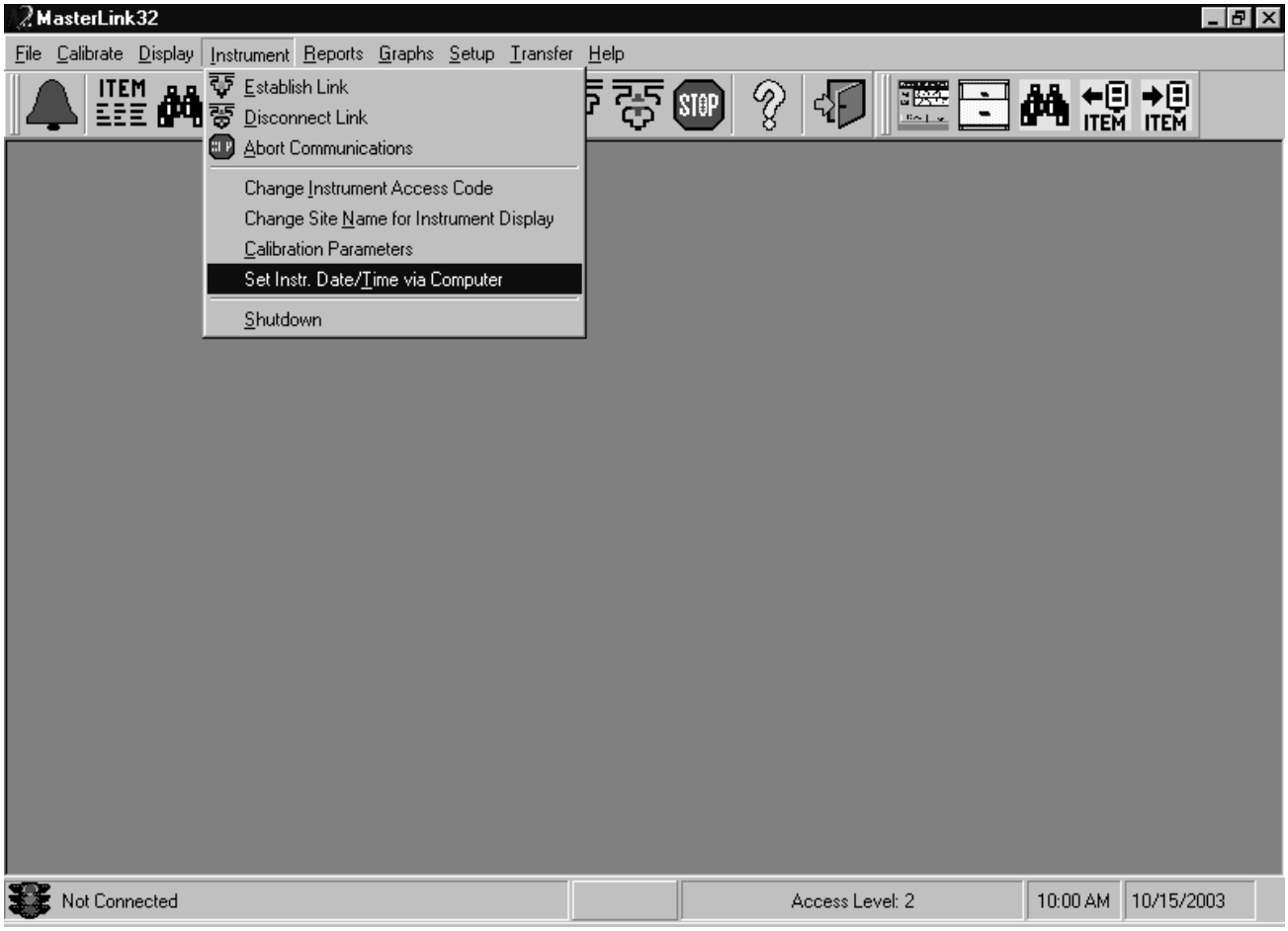
6. From the Transfer Menu, select Send Cal Items

7. MasterLink will display a warning message stating that "Transducer coefficients should not be altered." Click the Yes button to continue. MasterLink will now display a Calibration Options window. Make sure all boxes are checked and click OK to continue.

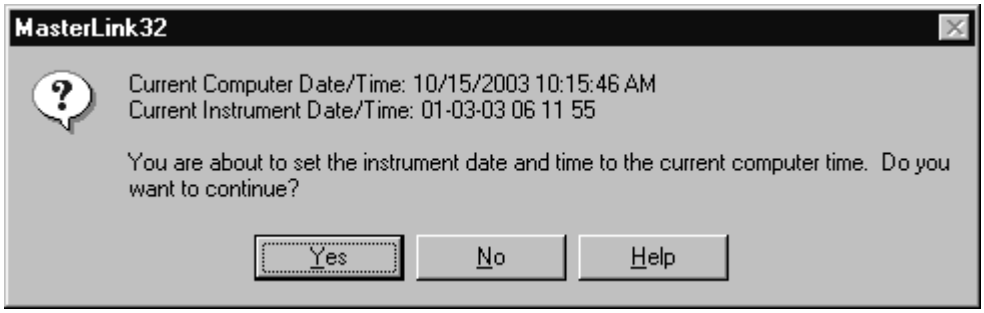




8. From the Instrument Menu, select Set Instr. Date/Time via computer.



9. Verify that the correct time and date are being sent to the instrument. Click Yes to send the time and date and finish the instrument setup.



Taking the Mini-AT "Unconfigured"

"Unconfigured" refers to returning the internal memory parameters back to factory default settings. After the Mini-AT goes unconfigured, historical data (such as; Audit Trail, Event Log and Alarm Log information), totalized volumes, calibration information and instrument settings are all cleared. Therefore, if this data is needed for any reason, **download the audit trail information, event log, and item files before taking the Mini-AT unconfigured.** Specific information about downloading these files is available in the Mini-AT Link Software Manual.

Use the following steps to take the Mini-AT "Unconfigured":

1) Put the instrument into "Shutdown" using Mini-AT Link for Windows or MasterLink32 software.

2) Unplug the main battery cable (at J7 or J8) and the backup battery cable (at J26) from the main board.

3) Place a jumper between pins 3 and 4 on JB24. See figure 1 on page 8 for the approximate location of JB24 on the main board and refer to page 74 for information on JB24.

4) Plug in the main battery cable (or alternative power source). **It is important to plug in the main battery (or alternative power source) before plugging in the backup battery.**

5) Plug in the backup battery into the main board at connector J26. The Mini-AT's LCD should display "00000000" indicating that the instrument is operating in the Corrector Mode and the settings have reverted back to factory default values.

6) Connect to the Mini-AT with a serial connection and configure the instrument to your company's specifications. **NOTE: Item 126 in an unconfigured instrument will default to 9600 baud. You must configure your Mercury software for 9600 baud in order to make the initial connection.**

7) Remove the jumper from JB24, pins 3&4.

Putting the Mini-AT into "Shutdown"

Shutdown is a 'mode of operation' invoked by the user prior to placing the instrument into storage or prior to performing some type of board maintenance. The Mini-AT Link software manual describes the procedure for putting the Mini-AT into Shutdown.

There are two types of Shutdown that can be induced into the Mini-AT, ***Partial*** and ***Complete***. The connection status of the battery packs determines which type of Shutdown the instrument assumes.

1) **Partial Shutdown:** To put the Mini-AT into "partial shutdown", from MasterLink32 software, select and confirm "SHUTDOWN" from the "Instrument" menu. Leave the main battery and backup battery plugged-in.

   In partial shutdown, the instrument's real-time clock will continue to update; however, new volume pulses will not be counted and the instrument will not display corrected gas volume. The LCD will show dashes "- - - - - - - -" across the display. The instrument still draws normal back ground current from the main battery when placed in partial shutdown, but it preserves all item values and audit trail information.

   To recover from a partial shutdown, i.e., return to Correct Mode, simply establish a serial link with the Mini-AT using the standard Mini-AT to computer cable (40-1629) and any software package that communicates with the Mini-AT.

2) **Complete Shutdown:** To put the Mini-AT into "complete shutdown", from MasterLink32 software, select and confirm "SHUTDOWN" from the "Instrument" menu, then pull the plugs to both the main battery (or other power source) and the backup battery (J26). In complete shutdown, the instrument's clock will stop working and new volume pulses will not be counted. The instrument's configuration data and all item values are retained in E^2PROM, however, audit trail and AGA8 data will be lost. The LCD display will be blank once the batteries are unplugged.

   In order to bring the Mini-AT out of a complete shutdown, simply plug in the main battery and the backup battery. It will be necessary to reset the date, time, corrected volume, uncorrected volume and other items that were erased as a result of the complete shutdown.

Item Code List

Items which make up the operating parameters, codes, alarms, calibration references , voltage levels, and other information relative to operation or configuration of the Mini-AT are listed below. Item code information can only be changed using Mini-AT Link (or MasterLink32) software. Refer to the Mini-AT Link Software Manual for more information.

Item No.	Item Name	Description
000	COR VOL	Totalized Corrected Volume, corrected to base conditions (PT&S). Value is scaled to volume units selected at item 090, with the number of digits defined by item 096.
001	PCORVOL	Totalized Pressure Corrected Volume, corrected to pressure base without supercompressibility (P). Value is scaled to volume units selected at item 091, with the number of digits defined by item 096.
002	UNC VOL	Totalized Uncorrected Volume. Value is scaled to volume units selected at item 092, with the number of digits defined by item 097. UncVol should agree with the mechanical index if initially synchronized
003	COR VOL @LO PRES	Totalized volume of gas metered at pressures lower than selected pressure low limit (Item 11), corrected to base conditions.
004	COR VOL @HI TEMP	Totalized volume of gas metered at temperatures above selected high limit (Item 28), corrected to base conditions.
005	A: NO OUT PULSES	Number of Pulser-A output pulses remaining from last wake-up period, waiting to be sent to a remote device.
006	B: NO OUT PULSES	Number of Pulser-B output pulses remaining from last wake-up period, waiting to be sent to a remote device.
007	C: NO OUT PULSES	Number of Pulser-C output pulses remaining from last wake-up period, waiting to be sent to a remote device.
008	PCOR GAS PRESS	Gas pressure measured at the last wake-up and used in the pressure factor calculation (Item 044). The pressure value is scaled to the unit of measure selected at item 087 and displayed with the appropriate number of decimal positions as selected at item 088. If the instrument is set to fixed-factored pressure (item 109) , item 008 should be manually set to the average flowing pressure used in the supercompressibility calculations, if super is active (item 110).

Item No.	Item Name	Description
009	PCOR PRESS MAX	Highest PCor pressure measured by the unit since last manually reset.
010	PCOR PRES HILIM	High limit for PCor pressure, initiates alarms (items 105 and 145), if exceeded. **Default** = 099999.99
011	PCOR PRES LOLIM	Low limit for PCor pressure, initiates alarms (items 105 and 143), if exceeded. Also used with item 003. **Default** = 0.00
012	ATM CALREF	Local atmospheric pressure entered by the instrument technician during the most recent calibration of an absolute pressure transducer. **Default** = 0.0000
013	BASE PRESS	Base pressure per the contract, used in calculating pressure correction factor (item 044). **Default** = 14.7000
014	ATM PRESS	Average atmospheric pressure per the contract, used in calculating pressure correction factor (item 044) when a gauge transducer is installed (item 112 = Gauge). This value is ignored if an absolute transducer is installed. (item 112 = Absolute). **Default** = 14.7000
015	PCOR REF PRES#1	The pressure value used during the most recent PCor ZERO calibration. **Default** = 0.00
016	PCOR REF PRESS#2	The pressure value used during the most recent PCor SPAN calibration. **Default** = 0.00
017	PCOR CAL ZERO	The most recent offset value for the pressure transducer, obtained during a PCor-Zero calibration. The value is normally very close to 0.0000 and is recalculated during each PCor Pressure Zero Calibration. **Default** = 0.0000
018	1 PREV PCOR CAL ZERO	The previous value of item 017, updated on each PCor Pressure Zero Calibration. **Default** = 0.0000

Item No.	Item Name	Description
019	2 PREV PCOR CAL ZERO	The previous value of item 018, updated on each PCor Pressure Zero Calibration. **Default** = 0.0000
020	PCOR CAL SPAN	The most recent span value for the pressure transducer, obtained during a PCor-Span calibration. The value is normally very close to 1.0000 and is calculated on each PCor Pressure Span Calibration. **Default** = 1.0000
021	1 PREV PCOR CAL SPAN	The previous value of item 020, updated on each PCor Pressure Span Calibration. **Default** = 1.0000
022	2 PREV PCOR CAL SPAN	The previous value of item 021, updated on each PCor Pressure Span Calibration. **Default** = 1.0000
023	MIN PCAL PT DIF%	The configurable spread or difference (expressed in percent of full-scale of pressure range) required between PZERO and PSPAN calibration points. **Default** = 50.0000
024	XCESS PCAL CHNG%	The configurable, maximum allowable change (expressed in percent of full scale of pressure range) to PZERO and PSPAN calibration points. **Default** = 2.0000
025	PCOR TRANSDUCER RGE	The upper range limit of the installed PCor pressure transducer, always expressed in PSI. **Default** = 100.00
026	GAS TEMP	Gas temperature measured at the last wake-up and used in calculating the temperature correction factor (item 045). The temperature value is scaled to the unit of measure selected at item 089. If the instrument is set for fixed-factored temperature item (111), item 026 should be manually set to the average flowing temperature used in the supercompressibility calculations, if super is active (item 110). **Default** = 0.00
027	GAS TEMP LOLIM	Low limit for temperature, initiates alarm (item 106 and 144) if exceeded. **Default** = -35.00

Item No.	Item Name	Description
028	GAS TEMP HILIM	High limit for temperature, initiates alarm (items 106 and 146) if exceeded. Also used with Item 004. **Default** = 165.00
029	REF TEMP #1	The temperature value used during the most recent TZERO calibration. **Default** = 0.00
030	REF TEMP #2	The temperature value used during the most recent TCAL calibration. **Default** = 0.00
031	CASE TEMP	Temperature measured inside instrument case at last wake-up. **Default** = 0.00
032	CASE TEMP MAX	Highest case temperature measured by unit since last manually reset. **Default** = -40.00
033	CASE TEMP MIN	Lowest case temperature measured by unit since last manually reset. **Default** = 099999.99
034	BASE TEMP	Base temperature per the contract, used to calculate temperature correction factor (item 045). **Default** = 60.00
035	TCAL ZERO	The most recent offset value for the temperature transducer, obtained during a T-Zero calibration. The value is normally very close to 0.0000 and is recalculated during each Temperature Zero Calibration. **Default** = 0.0000
036	1 PREV TCAL ZERO	The previous value of item 035, updated on each Temperature Zero Calibration. **Default** = 0.0000
037	2 PREV TCAL ZERO	The previous value of item 036, updated on each Temperature Zero Calibration. **Default** = 0.0000

Item No.	Item Name	Description
038	TCAL SPAN	The most recent span value for the temperature transducer, obtained during a T-Span calibration. The value is normally very close to 1.0000 and is recalculated on each Temperature Span Calibration. **Default** = 1.0000
039	1 PREV TCAL SPAN	The previous value of item 038, updated on each Temperature Span Calibration. **Default** = 1.0000
040	2 PREV TCAL SPAN	The previous value of item 039, updated on each Temperature Span Calibration. **Default** = 1.0000
041	MIN TCAL PT DIF%	The configurable spread or difference (expressed in percent of full-scale of the temperature range, i.e. -40.00 to +170.00 F or 210 degrees) required between TZERO and TCAL calibration points. **Default** = 10.0000
042	XCESS TCAL CHNG%	The configurable, maximum allowable change (expressed in percent of full scale of temperature range) to TZERO and TCAL calibration points. **Default** = 2.0000
043	TOTAL COR FACTOR	Total correction factor calculated at the most recent wake-up and used as a multiplier to convert uncorrected volume to corrected volume. It is the product of the values at Items 044, 045, 046 and 047, i.e. values at: 44 x 45 x 46 x $(47)^2$. **Default** = 1.0000
044	PRESS COR FACTOR	Pressure correction factor calculated at the most recent wake-up using Boyle's Law for values at items 008, 013, and 014 when item 109 is set for LIVE. Items 044 and 008 may be fixed factored to any reasonable value, by the user, if item 109 is set for FIXED. **Default** = 1.0000
045	TEMP COR FACTOR	Temperature correction factor calculated at the most recent wake-up using Charles' Law for values at items 026 and 034 when item 111 is set for LIVE. Items 045 and 026 may be fixed factored to any reasonable value, by the user, if item 111 is set for FIXED. **Default** = 1.0000

Item No.	Item Name	Description
046	AUX COR FACTOR	Factor to provide for other possible corrections to metered volume, i.e. Water Vapor Content, Therms, etc. If not applicable, set to 1.0000. **Default** = 1.0000
047	UNSQUARED SUPER	AGA 3 / NX-19 or AGA 8 Supercompressibility factor calculated at the most recent wake-up from values at items 008, 026, 053, 054 and 055, if item 110 is set for LIVE. May be fixed factored to any reasonable value entered, by the user, if item 110 is set for FIXED. **Default** = 1.0000
048	BATTERY VOLTAGE	Main battery voltage measured at last wake-up. **Default** = 0.00
049	BATTERY LOLIM V	Low limit for main battery voltage, initiates alarm (item 099) if voltage drops below this value. **Default** = 5.50
050	SHUTDOWN VOLTAGE	The voltage level at which most of the electronic circuits terminate operation. "..H.E.L.P.." is displayed on the LCD as an indication that the battery is dead and needs replaced. The upper limit setting for this item is 5.50 volts. **Default** = 4.80
051	BKUP BATT VOLTS	Voltage level of the Backup Battery measured at the most recent wake-up. **Default** = 0.00
052	BKUP BATT LOLIM V	Low voltage limit for Backup Battery, initiates alarm (item 101) if voltage drops below this value. **Default** = 3.60
053	SP GR FOR SUPER	Specific gravity, entered by the user, for calculating NX-19 Supercompressibility factor at item 047. **Default** = 0.6000
054	% N2 FOR SUPER	Percentage of Nitrogen molecules, entered by the user, for calculating NX-19 supercompressibility factor at item 047. **Default** = 0.0000
055	% CO2 FOR SUPER	Percentage of Carbon Dioxide molecules, entered by the user, for calculating NX-19 supercompressibility factor at item 047. **Default** = 0.0000

Item No.	Item Name	Description
056	PULSER A SCALING	Scaling factor that determines the volume per pulse for channel A pulse outputs when item 093 is set to CorVol, UncVol or PcorVol. **Default** = 2.0000
057	PULSER B SCALING	Scaling factor that determines the volume per pulse for channel B pulse outputs when item 094 is set to CorVol, UncVol or PcorVol. **Default** = 2.0000
058	PULSER C SCALING	Scaling factor that determines the volume per pulse for channel C pulse outputs when item 095 is set to CorVol, UncVol or PcorVol. **Default** = 2.0000
059	BATT WAKE CYCLES	A number incremented by "1" for each correction-cycle wake-up, i.e., each meter revolution. The value should be manually reset back to zero when a new battery pack is installed. **Default** = 0 The value also increments during all user accesses and other actions based on the equivalent wake-cycles listed below. **Action** — **Wake-Cycles (*approx.)** 1 meter revolution — 1 1 Audit Trail Log Entry — 2* 1 minute of Serial Link — 1435* 1 minute of Meter Reader — 913* 66 Form-A pulses (1-Ch) — 14* 240 Form-C pulses (1-Ch) — 14* Midnight roll-over (each day) — 6200
060	BATT CYCLES LIM	A high limit for the number of wake-up cycles accumulated. Initiates an alarm (item 100) when exceeded. Intended as early warning to change-out the main battery pack. **If a DCPS is installed, set item 060 to a value of "0" to disable the alarm feature. Also, reset item 049 to a value of "6.75" volts** **Default** = 15,000,000 Alkaline Battery Pack 40,000,000 Lithium Battery Pack 0 DCPS
061	DISPLAY TEST	A test pattern that displays all segments and decimal points of the LCD numeric display. By default, item 061 is the first item programmed into Mag List 1. This insures that the LCD status is viewed prior to displaying item values. Example: 8.8.8.8.8.8.8.8

Item No.	Item Name	Description
062	SERIAL NUMBER	Factory assigned Instrument Serial Number. Example: 09901234 **0**9901234 - disregard the leading zero. 0**99**01234 - 2 digit year of manufacture. 099**01234** - 5 digit sequence # during the year of manufacture. **Default** = 00000000
063	PCOR MIN PRESS	Lowest PCor pressure measured at item 008 since last manual reset. **Default** = 099999.99
064	GAS TEMP MAX	Highest temperature measured at item 026 since last manual reset. **Default** = -40.00
065	GAS TEMP MIN	Lowest temperature measured at item 026 since last manual reset. **Default** = 099999.99
066	PULSER A LIMIT	High limit for the number of pulses accumulated in item 005. Initiates an alarm (item 069) when exceeded. **Default** = 99999999
067	PULSER B LIMIT	High limit for the number of pulses accumulated in item 006. Initiates an alarm (item 070) when exceeded. **Default** = 99999999
068	PULSER C LIMIT	High limit for the number of pulses accumulated in item 007. Initiates an alarm (item 071) when exceeded. **Default** = 99999999
069	PULSER A ALARM	If the value at item 005 (Pulser A) exceeds the Pulser A Limit (item 066), an alarm is initiated. The LCD will display 'dots' while in the Corrector Mode, and item 069 will display "11111111" if view by the Meter Reader Mode or software. "00000000" is displayed if item 069 has no alarm. **Default** = 00000000
070	PULSER B ALARM	If the value at item 006 (Pulser B) exceeds the Pulser B Limit (item 067), an alarm is initiated. The LCD will display 'dots' while in the Corrector Mode, and item 070 will display "11111111" if view by the Meter Reader Mode or software. "00000000" is displayed if item 070 has no alarm. **Default** = 00000000

Item No.	Item Name	Description
071	PULSER C ALARM	If the value at item 007 (Pulser C) exceeds the Pulser C Limit (item 071), an alarm is initiated. The LCD will display 'dots' while in the Corrector Mode, and item 071 will display "11111111" if view by the Meter Reader Mode or software. "00000000" is displayed if item 071 has no alarm. **Default** = 00000000
072	ALARM 1 ITEM #	Item number for the first of three user-selectable, optional alarms. Intended choices are: 000 = unassigned 105 = Pressure Out of Range 106 = Temperature Out of Range **Default** = 000
073	ALARM 2 ITEM #	Item number for the second of three user-selectable, optional alarms. Intended choices are: 000 = unassigned 105 = Pressure Out of Range 106 = Temperature Out of Range **Default** = 000
074	ALARM 3 ITEM #	Item number for the third of three user-selectable, optional alarms. Intended choices are: 000 = unassigned 105 = Pressure Out of Range 106 = Temperature Out of Range **Default** = 000
075	MAG LIST 2 ITM 1	Item number of the first item displayed in MAG LIST #2. The display of this selection follows the display of LIVE Parameters (if enabled at item 129) or the last MAG LIST 1 ITEM (if enabled, items 130-135). If neither LIVE Parameters nor MAG LIST 1 items are enabled, the item programmed into item 075 will be the first Mag Read Item to be displayed in the Meter Reader List. Any Mini-AT item number may be entered as a Mag Read Item. **Default** = 200 (Site ID number)
076	MAG LIST 2 ITM 2	Item number of the next Mag List #2 item. Any item code may be selected, or enter the value "255" at this item to indicate the End-of-List. **Default** = 113 (Hi Res CorVol)
077	MAG LIST 2 ITM 3	Same as Item 76 above. **Default** = 013 (Base Pressure)

Item No.	Item Name	Description
078	MAG LIST 2 ITM 4	Same as Item 76 above. **Default** = 014 (Atmospheric Pressure)
079	MAG LIST 2 ITM 5	Same as Item 76 above. **Default** = 025 (Press. Transducer Range)
080	MAG LIST 2 ITM 6	Same as Item 76 above. **Default** = 044 (Pressure Corr. Factor)
081	MAG LIST 2 ITM 7	Same as Item 76 above. **Default** = 043 (Total Corr. Factor)
082	MAG LIST 2 ITM 8	Same as Item 76 above. **Default** = 048 (Battery Voltage)
083	MAG LIST 2 ITM 9	Same as Item 76 above. **Default** = 031 (Case Temperature)
084	MAG LIST 2 ITM 10	Same as Item 76 above. **Default** = 203 (Time)
085	MAG LIST 2 ITM 11	Same as Item 76 above. **Default** = 204 (Date)
086	MAG LIST 2 ITM 12	Same as Item 76 above. **Default** = 255 (End-of-List)
087	PCOR PRESS UNITS	Code (**0-9**) that selects the unit of measure for Gas Pressure (008) and other pressure related items. Select: **0** - PSIG--**Default** **5** - mBAR **1** - PSIA **6** - KGcm2 **2** - kPa **7** - in WC **3** - mPa **8** - in HG **4** - BAR **9** - mmHG
088	PCOR PRESS DISPL RES	Code (**0-4**) that selects the number of decimal positions to the right of decimal point for item 008 and other pressure related items. Select: **0** - x x x x x x x **1** - x x x x x x x**.**x **2** - x x x x x x**.**x x------**Default** **3** - x x x x x**.**x x x **4** - x x x x**.**x x x x

Item No.	Item Name	Description
089	TEMP UNITS CODE	Code (**0-3**) that selects the unit of measure for Gas Temperature (026) and other temperature related items. Select: **0** - Degrees F------**Default** **1** - Degrees C **2** - Degrees R **3** - Degrees K
090	COR VOL UN CODE	Code (**0-20**) that selects the unit of measure for Corrected Volume (000) and other CorVol related items. **Default** = **8** (MCF)
091	PCOR VOL UN CODE	Code (**0-20**) that selects the unit of measure for Pressure Corrected Volume (001). **Default** = **8** (MCF)
092	UNC VOL UN CODE	Code (**0-20**) that selects the unit of measure for Uncorrected Volume (002) and other UncVol related items, except Inst. Dial Rate (218) and Peak Dial Rate (219), which are always expressed in cubic feet per hour. **Default** = **7** (CCF)

To properly use selections 15 - 20 at item 090, the appropriate energy factor must be manually placed into item 142 (Gas Energy Value).

Possible selections for items 090, 091 and 092:

0 - CU FT
1 - CU FTx10
2 - CUFTx100
3 - CF
4 - CFx10
5 - CFx100
6 - CFx1000
7 - CCF
8 - MCF
9 - m3x0.1
10 - m3
11 - m3x10
12 - m3x100
13 - m3x1000
14 - CFx10000
15 - THERMS
16 - DKTHERMS
17 - MJOULES
18 - GJOULES
19 - KILOCAL
20 - KILOWATTHR

Item No.	Item Name	Description
093	PULSR A VOL CODE	Code (**0-4**) that selects the type of pulse information to be transmitted out Pulser Channel A.
094	PULSR B VOL CODE	Code (**0-4**) that selects the type of pulse information to be transmitted out Pulser Channel B.
095	PULSR C VOL CODE	Code (**0-4**) that selects the type of pulse information to be transmitted out Pulser Channel C. Possible selections for items 093, 094 and 095: Select: **0** - COR VOL **3** - NO OUTPUT **Default** **1** - PCor VOL **4** - TIME **2** - UNC VOL
096	COR VOL DISP RES	Code (**0-4**) that selects the number of digits (out of eight) to be blanked on the left-side of the corrected volume display (item 000). Example: Select: **0** - NO BLANKS--**Default** 12345678 **1** - 1 BLANK 2345678 **2** - 2 BLANK 345678 **3** - 3 BLANK 45678 **4** - 4 BLANK 5678
097	UNC VOL DISP RES	Code (**0-4**) that selects the number of digits (out of eight) to be blanked on the left-side of the uncorrected volume display (item 002). Example: Select: **0** - NO BLANKS--**Default** 12345678 **1** - 1 BLANK 2345678 **2** - 2 BLANK 345678 **3** - 3 BLANK 45678 **4** - 4 BLANK 5678
098	METER INDEX CODE	Code (**0-8**) that selects the value of each uncorrected input pulse. The selection should agree with the gas meter drive rate, i.e. the amount of uncorrected volume per output shaft rotation (or meter pulse). Select: **0** - 1 CF **5** - .1m3 **1** - 5 CF **6** - 1 m3 **2** - 10 CF------**Default** **7** - 10 m3 **3** - 100 CF **8** - 100 m3 **4** - 1000 CF

Item No.	Item Name	Description
099	BATTERY LOW	This item (099) indicates if a low voltage alarm for the main battery was generated. During a wake-cycle, if the measurement for item 048 (BATTERY VOLTAGE) is a value less than the value at item 049 (BATTERY LOLIM V), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 099. "00000000" at item 099 indicates there is no Low Battery Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. **Default** = 00000000
100	BATT CYCLES ALRM	This item (100) indicates if a high wake-cycle alarm for the main battery was generated. During a wake-cycle, if the calculated value for item 059 (BATTERY WAKE-UP CYCLES) is a value greater than the value at item 060 (BATT CYCLES LIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 100. "00000000" at item 100 indicates there is no Battery Cycles Alarm. The alarm indicators will remain active until manually cleared (by software). **Default** = 00000000
101	BKUP BATTERY LOW	This item (101) indicates if a low voltage alarm for the backup battery was generated. During a wake-cycle, if the measurement for item 051 (MEMORY BATTERY VOLTAGE) is a value less than the value at item 052 (MEM BATT LOVOLT LIMIT), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 101. "00000000" at item 101 indicates there is no Low Mem Battery Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. **Default** = 00000000
102	INDEX SW#1 FAULT	This item (102) indicates if an alarm for index switch #1 was generated. If index switch #1 fails to provide an input meter pulse within four meter revolutions, an alarm is initiated and is indicated by placing dots on the LCDand "11111111" at item 101. "00000000" at item 101indicates there is no Switch #1 Alarm. The alarm indicators will remain active until manually cleared (by software). **Default** = 00000000

Item No.	Item Name	Description
103	INDEX SW#2 FAULT	This item (103) indicates if an alarm for index switch #2 was generated. If index switch #2 fails to provide an input meter pulse within four meter revolutions, an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 102. "00000000" at item 102 indicates there is no Switch #2 Alarm. The alarm indicators will remain active until manually cleared (by software). **Default** = 00000000
104	A/D FAULT	This item (104) indicates if an alarm for A/D Converter was generated. If the microprocessor detects an A/D fault (Analog to Digital), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 104. "00000000" at item 104 indicates there is no A/D Converter Alarm. The alarm indicators will remain active until manually cleared (by software). Unlike other instrument alarms, an A/D Fault is usually a hardware failure which requires component replacement on the main circuit board, which is not a field repair unless the main board is replaced **Default** = 00000000
105	PRESS OUT RANGE	If item 105 is programmed into item 072, 073 or 074, this item (105) indicates if a high or low pressure alarm was generated. During a wake-cycle, if the measurement for item 008 (GAS PRESSURE) is a value less than the value at item 011 (PRES LO LIM) or a value greater than the value at item 010 (PRES HI LIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 105. "00000000" at item 105 indicates there is no Pressure Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see items 143 and 145. **Default** = 00000000

Item No.	Item Name	Description
106	TEMP OUT RANGE	If item 106 is programmed into item 072, 073 or 074, this item (106) indicates if a high or low temperature alarm was generated. During a wake-cycle, if the measurement for item 026 (GAS TEMPERATURE) is a value less than the value at item 027 (TEMP LO LIM) or a value greater than the value at item 028 (TEMP HI LIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 106. "00000000" at item 106 indicates there is no Temperature Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see items 144 and 146. **Default** = 00000000
108	ALARMS OUTPUT	This item (108) displays "11111111" to indicate that a standard alarm (069-071, 099-104, 143-146, 163 or 222) or a selected optional alarm (105 or 106) has become active, and that an alarm pulse was transmitted out the Alarm Channel. "00000000" at item 108 indicates no alarms became active since the last 'Clear Alarms'. **Default** = 00000000
109	FIXED PRESS FACT	Code (**0 or 1**) that selects Live or Fixed Factor Pressure. When enabled for Fixed Factor, the Pressure Factor entered at item 044 will be used for pressure correction, instead of a Live pressure factor calculation based on the input from the pressure transducer (item 008). NOTE: if item 109 is "Fixed", a value ***must*** be entered at item 044. It may also be necessary to enter a value at item 008 (Gas Pressure) if Supercompressibility (item 110) is "Live". Select: **0** - No Fixed Factor (Live) **Default** **1** - Fixed Factor
110	FIXED SUPER FACT	Code (**0 or 1**) that selects Live or Fixed Supercompressibility. When enabled for Fixed Super, the Unsquared Super Factor entered at Item 047 will be used for Supercompressibility Correction, instead of a Live Super calculation. NOTE: if item 110 is "Fixed", a value ***must*** be entered at item 047. Entering a fixed Super value of "1.0000" will essentially disable the Supercompressibility function. Select: **0** - No Fixed Factor (Live) **Default** **1** - Fixed Factor

Item No.	Item Name	Description
111	FIXED TEMP FACT	Code (**0 - 2**) that selects Live or Fixed Factor Temperature. When enabled for Fixed Factor (code 1), the Temperature Factor entered at Item 045 will be used for temperature correction, instead of a live calculation based on the input from the temperature probe. NOTE: if item 111 is "Fixed", a value ***must*** be entered at Item 045. It may also be necessary to enter a value at Item 026 (Gas Temperature) if Supercompressibility is "Live". If the selection for Item 111 is code 2 (Super), the total correction factor will include the Fixed Factor entered at Item 045 (usually 1.0000), while using the Live gas temperature from the temperature probe for the supercompressibility calculation. The code 2 selection was made available for sites with TC meters Select: **0** - No Fixed Factor (Live) **Default** **1** - Fixed Factor **2** - Fixed Factor Temperature with Live Measured Temperature for Supercompressibility Computations.
112	PCOR XDUCER TYPE	Code (**0 or 1**) to indicate the type of pressure transducer installed. Since the equations to calculate pressure correction and supercompressibility are dependant upon the transducer type, make sure the selection at items 087 and 112 are properly configured for the installed transducer. Select: **0** - Gauge------ **Default** **1** - Absolute
113	HI RES COR VOL	Display of the fractional portion (to the 4th decimal) of item 000 (Totalized Corrected Volume) with the last three CorVol integers for reference. Example: if the value at item 000 equals '12345678 MCF', item 113 may appear as '678.2477 MCF'. The four decimal places are useful during field calibration checks when using a small number of meter revolutions. **Default** = 000.0000
114	METER SCALING	Scaling factor for uncorrected volume input applied to the value selected at item 098 (Meter Index Rate). Usually used if the volume input is a value other than 0.1, 1, 5, 10, 100, 1000, as is the case when an HFI board or 4-pole magnet disc is installed. **Default** = 1.0000

Item No.	Item Name	Description
115	OUTPUT PULSE CD	Code (**0 - 4**) to provide slower pulse rates for remote counter/ readout devices that require more time to process volume pulses. For a Form-C output, the coded value represents the pulse width in milliseconds. For Form-A output, the coded value represents the total pulse cycle in milliseconds. One Form-A pulse cycle is equal to the pulse-on time plus the pulse-off time. The standard pulse-on time for a Form-A output is 62.5 milliseconds. Any remaining time is off-time. The pulse width from a Mini-AT may be changed by installing shunt resistors at JB29. Note: If the Form-A pulse width is changed from 62.5 milliseconds, item 115 must be set to a value equal to or greater than twice the pulse width. Example: With a shunt resistor for 250 millisecond pulse installed at JB29, item 115 would normally set to code-4. However, item 115 may also be set to codes 1 & 2, but not to codes 0 & 3. Form-C / Form-A Select: **0** - 62.5 / 125 **Default** **1** - 500 / 1000 **2** - 1000 / 2000 **3** - 125 / 250 **4** - 250 / 500
116	SQUARED SUPER	Supercompressibility factor squared $(Fpv)^2$, i.e., the square of the value at item 47. The value at item 116 is one of the factors included to obtain Total Correction Factor (item 43). **Default** = 1.0000
117	TAG NUMBER	User assigned tag number for instrument. **Default** = 00000000
118	REF NUMBER #1	User assigned reference number. Has no specific function other than to provide a convenient location to store an integer number for an undefined purpose. **Default** = 00000000
119	REF NUMBER #2	A second, user assigned reference number. Has no specific function other than to provide a convenient location to store an integer number for an undefined purpose. **Default** = 00000000

Item No.	Item Name	Description
120	PCOR PRESS CAL DATE	Date of the most recent change to PCor CAL ZERO (Item 017). The date is automatically inserted into item 120 when exiting the PCor CAL ZERO calibration function **Default** = 01-01-98
121	TEMP CAL DATE	Date of the most recent change to TCAL ZERO (Item 035). The date is automatically inserted into item 121 when exiting the TCAL ZERO calibration function **Default** = 01-01-98
122	FIRMWARE	This item displays the instrument's operating firmware version number. The version number reported is automatically inserted when a firmware file is uploaded into FLASH memory. The Flash Access Security Jumper must be installed at JB24 pins 5 & 6, prior to attempting to upload a firmware file.
123	AUDIT TRAIL ENABLE	Obsolete item
124	REVS PER WAKE-UP	This parameter (N) is used to determine the number of meter revolutions required before a full wake-up is initiated and new analog measurements are taken. All other meter revolutions will result in intermediate wake-ups. This function is a carry-over from the ECAT/Mini as a power conservation feature on fast meters having fairly constant pressures and temperatures. The significance of this feature in the Mini-AT is less since the power drain on the battery is less. Range - 0 to 15 **Default** = 1
125	PULSER POWER FACTOR	This parameter provide a method of assigning a power consumption factor to output pulses. The factor, selected by the user, permits accurately accounting for battery power, at item 59, during the transmission of volume pulses. Valid factors are from 1 to 255. The following table list factors for different pulse output combinations. **Default** = 66

	Power Factor		
Pulse Width	1-Channel Form-C	1-Channel Form-A	2-Channel Form-A
62.5	240	66	33
125	240	37	19
250	240	20	10
500	240	10	5
1000	240	5	3

Item No.	Item Name	Description
126	BAUD RATE CODE	Code (**0 - 7**) to select the instrument's baud rate for a local serial connection. A communication error will result if the baud rate does not match the baud rate of the connected computer. The 38.4 Kbaud selection is provided to achieve the fastest possible download times. A separate item (Item code 272) provides setting the baud rate for a modem connected at terminal strip TB2. Select: **0** - 9600------**Default** **4** - 600 **1** - 4800 **5** - 300 **2** - 2400 **6-** 19200 **3** - 1200 **7-** 38400
128	MAG ALARM ACKNOWLEDGE	Code (**0 or 1**) to enable or disable the clearing of all active alarms using the mag wand. During the Meter Reader List, an "E.E.E.E.E.E.E.E" display will appear after scrolling through all active alarms. Allowing the instrument to time-out (1-minute) at this display will clear all alarms. If instead, the mag wand is used to scroll to the next mag list item before the "E.E.E.E.E.E.E.E" display times-out, the alarms are not cleared. This feature is most useful if alarms need to be cleared and a laptop computer is not available. If item 128 is configured for "Disabled", the "E.E.E.E.E.E.E.E" pattern will never be displayed. Select: **0** - Disabled **1** - Enabled **Default**
129	LIVE DISP ENABLE	Code (**0 - 3**) to select the display of live gas pressure and/or live temperature as part of the Meter Reader List. If enabled, the live parameter(s) will appear after the display of the last Mag List 1, but before any Mag List 2 items. Both live gas pressure and temperature have a 30 minute time-out instead of the usual 1 minute. **Default = 3 - Live PCor & T** Select: **0** - None **4** - Live PLog **1** - Live PCor **5** - Live PCor & PLog **2** - Live T **6** - Live T & PLog **3** - Live PCor & T **7** - Live PCor, T & PLog
130	MAG LIST 1 ITEM 1	Item number of the first item displayed in the Meter Reader List, unless there are active alarms. Active alarms are always displayed prior to the selected mag list items. Any Mini-AT item may be entered as a mag list item. Enter a 255 for this item if the Mag List 1 function is to be disabled. See the section on using the Meter Reader List for more information. **Default** = 061 (Display Test)

Item No.	Item Name	Description
131	MAG LIST 1 ITEM 2	Item number of the second Mag List 1 item. Any Mini-AT item may be entered. Entered a 255 at this item to indicate the End-of-List for Mag List 1. **Default** = 002 (Uncorrected Volume)
132	MAG LIST 1 ITEM 3	Item number of the third Mag List 1 item. Any Mini-AT item may be entered. Entered a 255 at this item to indicate the End-of-List for Mag List 1. **Default** = 000 (Corrected Volume)
133	MAG LIST 1 ITEM 4	Item number of the fourth Mag List 1 item. Any Mini-AT item may be entered. Entered a 255 at this item to indicate the End-of-List for Mag List 1. **Default** = 255 (End-of-List)
134	MAG LIST 1 ITEM 5	Item number of the fifth Mag List 1 item. Any Mini-AT item may be entered. Entered a 255 at this item to indicate the End-of-List for Mag List 1. **Default** = 255 (End-of-List)
135	MAG LIST 1 ITEM 6	Item number of the sixth Mag List 1 item. Any Mini-AT item may be entered. Entered a 255 at this item to indicate the End-of-List for Mag List 1. **Default** = 255 (End-of-List)
136	ITEM # ENABLE	Code (**0 - 3**) to select if mag list items are to be identified by it's item code number. If enabled, the LCD will display the mag list sequence number, 3-dashes, and the item code number. Examples: "01 - - - 061" and " 1 - - - 048". The left-most digit(s) indicates the sequence number for either Mag List 1 or Mag List 2. A "0" at the left-most position indicates a Mag List 1 item, a non "0" character indicates a Mag List 2 item. The three right-most digits indicate the item code number for the value to be displayed on the next mag wand input. **Note**; Live Gas Pressure and Live Gas Temperature do not have mag list identifiers as there are no item code numbers associated with live parameters. Select: **0** - NONE--- **Default** **4** - LIVE **1** - LIST 1 **5** - LIST 1, LIVE **2** - LIST 2 **6** - LIST 2, LIVE **3** - LIST 1&2 **7** - LIST 1&2, LIVE

Item No.	Item Name	Description
137	PCOR XDCR RANGE	The upper PCor pressure range limit, automatically scaled to the pressure units selected at item 087. If PSI is the selected pressure units, then item 137 will be the same as item 025. Note; the value at item 137 may be manually edited to a rounded-off number, if desired. **Default** = 100.00
138	PCOR TRANSDUCER SER#	Serial number of the PCor pressure transducer (printed on the transducer label), manually inserted at the factory. Note: forcing Factory Defaults will **not** change the value of this item. **Default** = 00000000
139	SERIAL LINK CODE	Code (**0 - 2**) to define the behavior of the instrument's RS-232 serial data transfer with Mini-AT LINK and other 3rd-party software Select: **0** - Two Way (Read and Write) **Default** **1** - Read Only **2** - Disabled (Will not Read or Write)
140	ENERGY	The totalized gas energy, equivalent to the totalized corrected volume (item 000) multiplied by the Gas Energy Value (item 142) and updated every correction cycle. **Default** = 00000000
141	ENERGY UNIT CODE	The code (**0 - 5**) that selects the unit of measure for Energy (140). Select: **0** - THERMS ---**Default** **3** - GJOULES **1** - DKTHERMS **4** - KILOCAL **2** - MJOULES **5** - KILOWATTHR
142	GAS ENERGY VALUE	User-provided value to indicate the amount of energy contained in each volumetric unit of corrected volume. This value is a multiplier used to calculate Energy at item 140. The nominal Gas Energy Values for the various Energy Units (item 141) are listed below: THERMS - 1000 BTU per CuFt of gas **Default** DKTHERMS - 1000 BTU per CuFt of gas MJOULES - 37259.00 Kilojoules per m3 of gas GJOULES - 37259.00 Kilojoules per m3 of gas KILOCAL - 8905.00 Kilocalories per m3 of gas KILOWATTHR - 10349.73 Watt/Hr per m3 of gas

Item No.	Item Name	Description
143	PCOR PRESS LOW ALARM	This item (143) indicates if a low PCor pressure alarm was generated. During a wake cycle, if the measurement for item 008 (PCor GAS PRESSURE) is a value less than the value entered at item 011 (PCor PRES LOLIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 143. "00000000" at item 143 indicates there is no PCor Pressure Low Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see item 105. The PCor Pressure Low Limit value (item 011) is user selectable and is normally set somewhere between 0 and 50% of transducer range. **Default** = 00000000
144	TEMP LOW ALARM	This item (144) indicates if a low temperature alarm was generated. During a wake cycle, if the measurement for item 026 (GAS TEMPERATURE) is a value less than the value entered at item 027 (TEMP LOLIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 144. "00000000" at item 144 indicates there is no Temperature Low Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see item 106. The Temperature Low Limit value (item 027) is user selectable and is normally set somewhere between 0 and 50% of transducer range. **Default** = 00000000
145	PCOR PRESS HIGH ALARM	This item (145) indicates if a high PCor pressure alarm was generated. During a wake cycle, if the measurement for item 008 (PCor GAS PRESSURE) is a value greater than the value entered at item 010 (PCor PRES HILIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 145. "00000000" at item 145 indicates there is no PCor Pressure High Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see item 105. The PCor Pressure High Limit value (item 010) is user selectable and is normally set somewhere between 50 and 100% of transducer range. **Default** = 00000000

Item No.	Item Name	Description
146	TEMP HIGH ALARM	This item (146) indicates if a high temperature alarm was generated. During a wake cycle, if the measurement for item 026 (GAS TEMPERATURE) is a value greater than the value entered at item 028 (TEMP HILIM), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 146. "00000000" at item 146 indicates there is no Temperature High Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. Also see item 106. The Temperature High Limit value (item 028) is user selectable and is normally set somewhere between 50 and 100% of transducer range. **Default** = 00000000
147	COMPRESS TYPE	Selection to allow the user to choose the type of gas compressibility calculation employed during each correction cycle wake-up. Selection "0" (NX-19) results in the implementation of AGA-3 / NX-19 Supercompressibility calculations. Selection "1" (AGA-8) results in the implementation of AGA-8 calculations. Select: **0** - NX-19---**Default** **1** - AGA-8

Note: When selecting AGA-8, items 053 ,054 and 055 are disabled. However, the values at these items may be changed for reference only. AGA8 software must be used to create a computer file (*.aga), which includes user selectable values for Specific Gravity, $\%N_2$ and $\%CO_2$. The file must be transferred to the connected Mini-AT using "Transfer" | "Send AGA8 Factors" with Mini-AT Link Software. An AGA-8 file with defaulted values for Specific Gravity = 0.6000, $\%N_2$ = 0.0000 and $\%CO_2$ = 0.0000 is provided with each Mini-AT Link Software package. Other values for Specific Gravity, %N2 and %CO2 will require AGA-8 software to create a new .aga file(s).

148	INCREMNTL ENERGY	Same as item 140 (Energy) but is initialized to 00000000 after every TIME log-trigger (item 202). If interrogated, the value displayed indicates the most recently logged value. **Default** = 00000000

Item No.	Item Name	Description
149	EVENT LOG LOCK	The function of the Event Logger is to record: Date, Time, UserID#, assigned Sequence Number, Before value and After value for changes made to instrument item values or other specific user activity. By default, the Event Logger is 'Unlocked', meaning old event records begin to be overwritten after 500 event changes. The Event Log Lock can **only** be enabled with Mini-AT Link software when the Event Logger Lock Jumper is installed at JB24, pins 9 & 10. Once enabled (Locked), the functionality of the Event Logger conforms to Canadian regulations as specified by **Measurement Canada.** Several key requirements include: • After the Event Logger Lock is selected, the lock is permanent, i.e. it cannot be changed back to "Unlocked" • When the number of event records in memory reaches the maximum of 500 records, the Event Logger information must be downloaded to a computer before any additional instrument changes are permitted • New events are automatically numbered sequentially, starting at zero • Only changes that could affect "Billing" are recorded, all other item changes are not logged. Select: **0** - Unlocked --- **Default** **1** - Locked **Note:** Instruments shipped to Canada are factory-set with the Event Logger **LOCKED**
163	RATE HIGH ALARM	This item (163) indicates if a Corrected Volume Flow Rate alarm was generated. During a wake-cycle, if the value at item 209 (Instantaneous Flow Rate) was greater than the value entered at item 164 (Rate High Limit), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 163. "00000000" at item 163 indicates there is no High Flow Alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX (item 165) is enabled. This alarm can be disabled by setting the value at item 164 to its highest value of "99999.99". **Default** = 00000000
164	RATE HIGH LIMIT	Upper limit for High Flow Rate Alarm (item 163), initiates an alarm if exceeded. **Default** = 99999.99

Item No.	Item Name	Description
165	RBX ALARM ENABLE	Code (**0-1**) to determine the type of instrument alarm operation. When the RBX function (Report By Exception) is disabled, all instrument alarms operate as in previous versions of firmware, i.e., alarms stay active until manually cleared. When RBX is enabled, instrument alarms are automatically cleared after the alarm parameter returns to its normal operating range, buffered by a user-specified dead band. Exceptions; A/D Fault andSwitch Faults 1 & 2. "Alarm", "Alarm Ack" and "Alarm Clear" entries are time-stamped into the Alarm Logger to provide details of alarm activity. Also see Items 237 & 174 for related functions. Select: **0** - Standard Alarms------**Default** **1** - RBX Alarms
166	PCOR PRESS DEAD BAND	A hysteresis band that provides a buffer below the PCor Pressure Hi limit (item 010) and above the PCor Pressure Lo limit (item 011) when alarms are automatically cleared by RBX operation. The user-specified value determines the magnitude of the band. The PCor pressure measurement (item 008) must pass completely through the dead band before the pressure alarm is automatically cleared. **Default** = 5.00 PSIG
167	TMP DEAD BAND	A hysteresis band that provides a buffer below the Gas Temperature Hi limit (item 028) and above the Gas Temperature Lo limit (item 027) when temperature alarms are automatically cleared by RBX operation. The user-specified value determines the magnitude of the band. The temperature measurement (item 026) must pass completely through the dead band before the temperature alarm is automatically cleared. **Default** = 10.00 F
168	BATT DEAD BAND	A hysteresis band that provides a buffer above the Battery Low Limit Voltage (item 049) when the main Battery Low alarm is automatically cleared by RBX operation. The user-specified value determines the magnitude of the band. The battery voltage measurement (item 048) must pass completely through the dead band before the battery low alarm is automatically cleared. **Default** = 1.00 Volt

Item No.	Item Name	Description
169	RATE DEAD BAND	A hysteresis band that provides a buffer below the Rate High Limit (item 164) when the Rate High Alarm is automatically cleared by RBX operation. The user-specified value determines the magnitude of the band. The flow rate calculation (item 209) must pass completely through the dead band before the flow rate alarm is automatically cleared. **Default** = 2 xyz/HR Where: xyz = the CorVol unit selected at item 090
170	PROTOCOL CODE A	Selection (**0-1**) to determine if a specific Mercury Protocol error code is transmitted while attempting a serial link sign-on. When this function is set to "0", (which is the recommended setting for most applications) all instrument error codes are transmitted as in previous versions of firmware. When this item is set to "1", the Mini-AT will not send time-out errors during serial communications. The selection of "1" is provided as a convenience for some 3rd party communication interfaces. Select: **0** - Standard------**Default** **1** - No Time-out Error
171	TIMEOUT DELAY1	The time (in seconds) the Mini-AT waits for the host computer to send the protocol control character **"ENQ"** during instrument sign-on before issuing an error "21" (timeout error). This function is provided as a convenience for some 3rd party communication interfaces and under most situations, should not be changed from the default setting. Range: 7 to 60 **Default** = 7
172	TIMEOUT DELAY2	The time (in seconds) the Mini-AT waits for a valid **"sign-on"** from the host computer after receiving the protocol control character "ENQ" before issuing an error "21" (timeout error). This function is provided as a convenience for some 3rd party communication interfaces and under most situations, should not be changed from the default setting. Range: 7 to 60 **Default** = 7
173	REPORT TRIGGER 9	When activated, this trigger will cause an audit trail entry to time-stamp **Hardware Resets**. A Hardware Reset occurs when the microprocessor receives an interrupt from the low-voltage detector, indicating the instrument's main power dropped below 4.3 volts. This situation can occur while the instrument is 'asleep', therefore, would not produce a Low Battery Alarm or "HELP" shutdown. Select: **0** - Inactive **1** - Activated-----**Default**

Item No.	Item Name	Description
174	REPORT TRIGGER 10	When activated, this trigger will cause an audit trail entry to time-stamp **Alarms Cleared**, either manually or automatically by RBX. The Clear Alarm action will also provide an alarm output pulse and change item 176 (RBX ALARM EVENT) from "00000000" to "11111111" if item 165 (RBX ALARM ENABLE) is set to RBX Alarms (code **1**). Select: **0** - Inactive **1** - Activated-----**Default**
175	REPORT TRIGGER 11	When activated, this trigger will cause an audit trail entry to time-stamp instrument **Shutdown**. Select: **0** - Inactive **1** - Activated-----**Default**
176	RBX ALARM EVENT	This item provides an indication of RBX alarm activity since last interrogated. It normally displays "00000000" and is internally set to "11111111" when any alarm becomes activate or is cleared. It must be externally reset to "00000000" after each interrogation (if needed) to determine the status of future changes. **Default** = 00000000
177	PULSE REPETITION	The amount of time (in hours) an alarm pulse will be PERIOD retransmitted if the current alarm(s) have not been acknowledged (read). Setting this item to "0" will disable this feature. Integer values only, fractions are not allowed. Range: 0 to 24 **Default** = 24
183	PREV DAY CORVOL	Yesterday's Daily Corrected Volume, i.e., the daily corrected volume that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 223 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 00000000
184	PREV DAY UNCVOL	Yesterday's Daily Uncorrected Volume, i.e., the daily uncorrected volume that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 224 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 00000000

Item No.	Item Name	Description
185	PREDAY AV PCOR P	Yesterday's Daily Average PCor Pressure (expressed in the pressure units selected at item 087), i.e., the daily average PCor pressure that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 256 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 0.00
186	PREDAY AV TEMP	Yesterday's Daily Average Temperature (expressed in the temperature units selected at item 088), i.e., the daily average temperature that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 257 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 0.00
187	AVG UNSQ SUPER	The calculated Unsquared Supercompressibility Factor (item 047) averaged over the selected Time Interval (item 202). This value is "flow weighted", meaning, the calculations result from input meter pulses only and relate exactly to Average Pressure (item 206) and Average Temperature (item 207). This is a running average, so the value displayed during instrument access is the most recent calculated value. **Default** = 1.0000
188	DAILY AV UNS SUP	Same as item 187, except this value is the average supercompressibility Factor for the current Gas Day. This is a running average, which is zeroed and begins a new calculation at the time entered at item 205. Therefore, the value displayed during instrument access is the most recent calculated value for the current gas day. **Default** = 1.0000
189	PREDAY AV UN SUP	Yesterday's Daily Unsquared Supercompressibility Factor, i.e., the daily unsquared supercompressibility factor that is one 'Gas Day' old at the time instrument was accessed. This item is updated with the value from item 188 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 0.0000

Item No.	Item Name	Description
190	DAILY ENERGY	Same as item 140 (Energy), except this value is the running total for the current Gas Day, which is zeroed and begins a new calculation at the time entered at item 205. Therefore, the value displayed during instrument access is the most recent calculated value for the current gas day. **Default** = 00000000
191	PREV DAY ENERGY	Yesterday's Daily Energy, i.e., the daily energy that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 190 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 00000000
192	DAILY PK FLOW RT	Same as item 210 (Peak Flow Rate), except this value is the peak flow rate for the current Gas Day, which is zeroed at the time entered at item 205. Therefore, the value displayed during instrument access is the peak flow rate, up to that point in time, during the current gas day. **Default** = 00000000
193	DAILY PK FLOW TM	The ending-hour time the Daily Peak Flow Rate (192) occurred during the current gas day. **Default** = 00 00 00
194	PREDAY PK FLOW RT	Yesterday's Daily Peak Flow Rate, i.e., the daily peak flow rate that is one 'Gas Day' old at the time the instrument was accessed. This information is updated with the value from item 192 at the beginning of every new gas day. Note: The gas day begins at the time entered at item 205. **Default** = 00000000
195	PREDAY PK FLO TM	The ending-hour time the Previous Daily Peak Flow Rate (194) occurred during the previous gas day. **Default** = 00 00 00
196	EVENT USER ID	An identification number inserted into the Event Log to identify the person that caused the change(s) to the instrument's configuration. The default value is "0" but may be voluntarily changed to any number between "0" & "99" (inclusive) when prompted during instrument access. **Default** = 0

Item No.	Item Name	Description
197	MAX DIAL RATE	The highest Instantaneous Dial Rate (item 218) since last manually reset. **Default** = 0.00
198	MAX FLOW RATE	The highest Instantaneous Flow Rate (item 209) since last manually reset. **Default** = 0.00
199	DATE (DD-MM-YY)	The calender date displayed with the first two digits as 'DAY', the second two digit as 'MONTH' and the last two digits as 'YEAR'. **Note:** A date entered at this item (199), will also appear at item 204. The date format of item 204 is governed by the selection at item 262. If the Event Log Lock (item 149) is set to "1", then the Date Format (item 262) will be set to Code 2, YY-MM-DD. As a result, item 204 **and item 199** will get changed to YY-MM-DD format. At this point, item 262 may be changed to any of the format options and will be reflected at item 204, but item 199 cannot be changed from the YY-MM-DD format **Default** = 01-01-98 Format: DD-MM-YY
200	SITE ID	User assigned, eight digit numeric site number. Limited to characters: 0-9. The"**.**" and "**-**" are not valid characters. Note: All Mini-ATs downloaded using Mercury Instruments Windows-based software must be configured for unique Site ID Numbers at items 200 and 201. **Default** = 00000000
201	SITE ID PART 2	Eight additional digits for the site number, if needed. Note: All Mini-ATs downloaded using Mercury Instruments Windows-based software must be configured for unique Site ID Numbers at items 200 and 201. **Default** = 00000000
202	INTERVAL	User selected time periods that determines how often a time-stamp record is placed in audit trail memory Select: 15 (minutes) 30 (minutes) 60 (minutes)-----**Default** 24 (hours)

Item No.	Item Name	Description
203	TIME	Real Time Clock that displays hours, minutes, and seconds in 24-hour "military" time, i.e., 14: 30: 02 would be 2 seconds past 2:30 PM. **Default** = 12:00:00
204	DATE	A numeric field indicating either Month-Day-Year (MM-DD-YY), Day-Month-Year (DD-MM-YY) or Year-Month-Day (YY-MM-DD), depending on the Date Format selection at item 262. The Date automatically tracks the days in the month, including leap year. Leading zeros are required where applicable. This Date (and Time, item 203) is used to time-stamp records in Audit Trail, Event Logger and Alarm Logger memory. Note; The date entered at item 204 is also inserted at Item 199. **Default** = 01-01-98 Format: MM-DD-YY
205	START TIME	User selectable time to begin the start of the 'Gas Day', which by definition of other items, is the time of day when daily computations are re-zeroed to begin the next day's computations. Note: The time entered should contain zeros for minutes and zeros for seconds. **Default** = 08 00 00
206	PCOR AVG PRESS	Calculated PCor average pressure for the time interval selected at item 202. The average value is 'flow weighted', meaning the only PCor pressure measurements included are obtained at the time of uncorrected volume inputs. This relates exactly to the correction factors and is the equivalent of a pressure trace on a meter-driven volume chart. The average pressure is a running average, so the value displayed is the most recent value calculated. **Default** = 0.00
207	AVG TEMP	Calculated average temperature for the time interval selected at item 202. The average value is 'flow weighted', meaning the only temperature measurements included are obtained at the time of uncorrected volume inputs. This relates exactly to the correction factors and is the equivalent of a temperature trace on a meter-driven volume chart. The average temperature is a running average, so the value displayed is the most recent value calculated. **Default** = 0.00

Item No.	Item Name	Description
208	AVG FLOW RATE	Calculated average rate of flow for Corrected Volume (000) for the time interval selected at item 202, expressed in CorVol units per hour. Example: If the COR VOL UN CODE (item 090) is 7 (CCF) and 211,704 cubic feet of corrected volume were measured during the last log interval of 24 hours, the number displayed will be 88.21. **Default** = 0.00
209	INST FLOW RATE	The current instantaneous rate of flow for Corrected Volume (000), expressed in the selected CorVol units (item 090) per hour. The value is equal to the most recent increment of CorVol, divided by the length of time between the last two correction cycles. (The minimum acceptable time between correction cycles is one minute.) If the meter is rotating faster than 1 RPM, the calculation is delayed until the time is equal to, or is greater than, one minute. When accessed, the unit will display the most recently computed value. **Default** = 0.00
210	PEAK FLOW RATE	The highest INST FLOW RATE (item 209) during the current time interval (item 202), expressed in CorVol units (090) per hour. **Default** = 0.00
211	PEAK HOUR CORVOL	The largest amount of Corrected Volume measured over a 1-hour period during the 24 hour gas day. The 1-hour time periods are fixed, consecutive hours, i.e., 8:00 to 9:00, 9:00 to10:00, 10:00 to 11:00, etc. They are **not** moving 1-hour windows. **Default** = 00000000
212	PEAK HR END TIME	The ending-hour time for PEAK HOUR CORVOL (item 211). **Default** = 00 00 00
213	PEAK HOUR DATE	Date for PEAK HR END TIME (item 212). Format: Determined by item 262 **Default** 01-01-98
214	PCOR INTVL HI P	Highest PCor Gas Pressure (item 008) measured during the Time interval selected at item 202. The value at item 214 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = 0.00

Item No.	Item Name	Description
215	PCOR INTVL LO P	Lowest PCor Gas Pressure (item 008) measured during the Time interval selected at item 202. The value at item 214 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = 099999.99
216	INTVL HI TEMP	Highest Gas Temperature (item 026) measured during the Time interval selected at item 202. The value at item 214 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = -40.00
217	INTVL LO TEMP	Lowest Gas Temperature (item 026) measured during the Time interval selected at item 202. The value at item 214 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = 099999.99
218	INST DIAL RATE	"Instantaneous" meter flow rate derived from the UncVol meter pulses and expressed in Cubic Feet per hour or Cubic Meters per hour (depending on the selection at item 098). Similar to INST FLOW RATE (item 209), including the 1-minute time limitation. **Default** = 0.00
219	PEAK DIAL RATE	Highest value of item 218 during the current log interval. Similar to PEAK FLOW RATE (item 210). **Default** = 0.00
220	NOMINATED CORVOL	The nominated daily contract volume, with the value entered using the selected CorVol units (item 090). When the value for DAILY CORVOL (item 223) reaches the NOMINATED CORVOL (item 220), a time-stamp record is placed in audit trail memory, if item 236 is enabled. **Default** = 99999999
221	DAILY CORVOL LIMIT	High limit for daily contract volume, initiates an alarm (item 222) if exceeded **Default** = 99999999

Item No.	Item Name	Description
222	DAILY CORVOL ALM	During a wake cycle, if the computed value for item 223 (DAILY CORVOL) is greater than the value at item 221 (DAILY CORVOL LIMIT), an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 222. "00000000" at item 222 indicates there is no Daily CorVol Alarm. The alarm and alarm indicators are automatically cleared at the beginning of each Gas Day, regardless if RBX (item 165) is enabled or not. **Default** = 00000000
223	DAILY CORVOL	Same as CORVOL (item 000) but is initialized (re-zeroed) at the START TIME (item 205) of each Gas Day. If the instrument is accessed, this item will display the current value for that point in time. **Default** = 00000000
224	DAILY UNCVOL	Same as UNCVOL (item 002) but is initialized (re-zeroed) at the START TIME (item 205) of each Gas Day. If the instrument is accessed, this item will display the current value for that point in time. **Default** = 00000000
225	INCREMNTL CORVOL	Same as CORVOL (item 000) but is initialized (re-zeroed) at the beginning of every TIME-triggered wake-up (item 202). If the instrument is accessed, this item will display the current value for that point in time. **Default** = 00000000
226	INCREMNTL UNCVOL	Same as UNCVOL (item 002) but is initialized (re-zeroed) at the beginning of every TIME-triggered wake-up (item 202). If the instrument is accessed, this item will display the current value for that point in time. **Default** = 00000000

Item No.	Item Name	Description			
229	OPTN REP ITEM 1	The last six of ten, user selectable Audit Trail Report Items that can be placed in Audit Trail memory. The use of these six items is optional. If **any** of these six items are other than 255, the instrument is forced to store the maximum of ten audit items per record. In this case, up to five 255s can be used to specify a blank (unused) column. To configure audit trail memory for only four items per record, place a 255 in **all** six item codes (229 - 234). If audit trail memory is configured for four items and then is to be returned back to the default ten item arrangement, the instrument must be taken UNCONFIGURED by jumpering pins 3 & 4 of JB24 and cycling the power. This will erase all audit trail data, and re-map the RAM memory for ten item configuration.	**Default:**	048	(Battery Voltage)
230	OPTN REP ITEM 2	See above.	**Default:**	000	(CorVol)
231	OPTN REP ITEM 3	See above.	**Default:**	002	(UncVol)
232	OPTN REP ITEM 4	See above.	**Default:**	008	(PCor Gas Pressure)
233	OPTN REP ITEM 5	See above.	**Default:**	026	(Gas Temperature)
234	OPTN REP ITEM 6	See above.	**Default:**	059	(Battery Wake Cycles)
235	REPORT TRIGGER 1	Audit Trail Time Intervals:			TIME
236	REPORT TRIGGER 2	Daily Nominated Volume Reached:			VOLUME
237	REPORT TRIGGER 3	Alarm Activations:			ALARM
238	REPORT TRIGGER 4	Serial Access:			SERIAL
239	REPORT TRIGGER 5	Meter Reader (Mag Wand) Access:			MAG READ
240	REPORT TRIGGER 6	OBSOLETE			
241	REPORT TRIGGER 7	OBSOLETE			
242	REPORT TRIGGER 8	Changes to item values:			CHANGE

Item No.	Item Name	Description

For items 235 thru 239 and 242, code (**0 - 1**) to activate or deactivate the above listed audit trail Report Triggers. If activated, an audit trail record will appear in the audit trail log at the occurrence of each particular type of trigger. The entry appears as a time-stamp record, consisting of the following fields in a left-to-right order. If the unit is configured for just four audit trail items, Optional Report Items 1-6 are omitted from the audit trail record.

Column:	Field
1	DATE (204),
2	TIME (203),
3	SELECTABLE REPORT ITEM #1 (258),
4	SELECTABLE REPORT ITEM #2 (259),
5	SELECTABLE REPORT ITEM #3 (260),
6	SELECTABLE REPORT ITEM #4 (261),
7	OPTIONAL REPORT ITEM #1 (229),
8	OPTIONAL REPORT ITEM #2 (230),
9	OPTIONAL REPORT ITEM #3 (231),
10	OPTIONAL REPORT ITEM #4 (232),
11	OPTIONAL REPORT ITEM #5 (233),
12	OPTIONAL REPORT ITEM #6 (234),
13	REPORT TRIGGER (items 235-239, 242 or 173-175)

If any Report Trigger(s) is deactivated, that particular type of an event (trigger) will not appear as a time-stamped record in audit trail memory.

Select: **0** - Inactive
1 - Activated-----**Default**

243 MO PK HR CORVOL

The highest hourly CORVOL of the current 'Gas' month.
Default = 00000000

244 MO PK HR DATE

The date the current month Peak Hour CORVOL (243) occurred.
Format: Determined by item 262
Default = 01-01-98

245 MO PK HR TIME

Ending hour for the current month Peak Hour CORVOL Date (244).
Default = 00 00 00

246 MO PK DAY CORVOL

The highest Daily CORVOL (item 223) of the current 'Gas' month.
Default = 00000000

Item No.	Item Name	Description
247	MO PK DAY DATE	The date the current month Peak Day CORVOL (245) occurred. Format: Determined by item 262 **Default** = 01-01-98
248	PREMO PK HR CRVL	The highest hourly CORVOL of the previous 'Gas' month. **Default** = 00000000
249	PREMO PK HR DATE	The date the previous month Peak Hour CORVOL (248) occurred. Format: Determined by item 262 **Default** = 01-01-98
250	PREMO PK HR TIME	Ending hour for the previous month Peak Hour CORVOL Date (249). **Default** = 00 00 00
251	PREMO PKDAY CRVL	The highest Daily CORVOL (item 223) of the previous 'Gas' month. **Default** = 00000000
252	PREMO PKDAY DATE	The date the previous month Peak Day CORVOL (251) occurred. Format: Determined by item 262 **Default** = 01-01-98
253	MAX DAY CORVOL	The highest Daily CORVOL (item 223) since last manually reset. **Default** = 00000000
254	MAX DAY DATE	The date the MAX DAY CORVOL (253) occurred. Format: Determined by item 262 **Default** = 01-01-98
256	PCOR DAILY AVG PRESS	The daily average of PCor Gas Pressure (item 008) which will be reset to zero at the start of each Gas Day. **Default** = 0.00
257	DAILY AVG TEMP	The daily average Gas Temperature (026) which will be reset to zero at the start of each Gas Day. **Default** = 0.00

Item No.	Item Name	Description
258	SLTBLE REP ITEM 1	The first of four user selectable Audit Trail Report Items that can be configured for Audit Trail memory. To use these four items, insert the desired item code number into any of the report locations (258 - 261). The value "255" at any of these Report Items will cause that position to be 'blank'. The Audit Trail logger can be configured to record four **or** ten item values in each audit trail record. See Item Codes 229 - 234 for further information. **Default:** 225 (Incrv CorVol)
259	SLTBLE REP ITEM 2	See above. **Default:** 226 (Incrv UnVol)
260	SLTBLE REP ITEM 3	See above. **Default:** 206 (Avg. PCor Gas Pressure)
261	SLTBLE REP ITEM 4	See above. **Default:** 207 (Avg. Temperature)
262	DATE FORMAT	Code (**0 - 2**) to select the format in which the Date is entered and displayed at item 204. The format for all date related items (213, 244, 247, etc.) will also be governed by the selection of item 262. Select: **0** - MM:DD:YY-----**Default** **1** - DD:MM:YY **2** - YY:MM:DD
263	AT TIMELOG TIMESTAMP	Selection to determine how Audit Trail data is downloaded from the instrument. Selecting '0' will download audit trail records the same as in the past. (i.e. when a snapshot of the Audit Trail item values were taken.) Selecting '1' will shift interval based values (ex. Item 225 Incremental Corrected Volume) into the previous time log (i.e. start of the interval). Absolute values (ex. Item 000 Corrected Volume) will remain in their original time log (i.e. end of the interval). This feature was added to allow incremental Audit Trail data (consumption) to be displayed at the time interval of its usage. Select: **0** - End of Interval **Default** **1** - Start of Interval
268	JUMPER SETTINGS	The Mini-AT incorporates jumpers on the main circuit board as another means of configuring some modes of operation. Since the jumpers are physical entities, they cannot be changed via software. Item 268 provides a means of reporting which jumpers are installed at JB24. Normally (i.e. default), the only jumper installed at JB24 is across pins 5 & 6. Other jumper may be installed if those particular features to be enabled (see Table 4).

Item No.	Item Name	Description
272	MODEM BAUD RATE	Code (**0 - 7**) to select the communication's baud rate for the modem at the Mini-AT, wired into terminal strip TB2. A communication error may result if the baud rate at item 272 does not match the baud rate of the connected modem. (Baud rate jumpers JP4 and JP5 on the Mercury Modem board should be set to match the baud rate at item 272. The jumpers can be set for 1200, 2400 and 9600 baud, avoid the 19.2kbaud setting.) A separate item (Item code 126) provides setting the baud rate for the local serial connection at the RS-232 port. Select: **0** - 9600------**Default** **4** - 600 **1** - 4800 **5** - 300 **2** - 2400 **6-** 19200 **3** - 1200 **7-** 38400
273	MAX FLOW RATE	The highest value of Inst Flow Rate (item 209) since the last manual reset. **Default** = 0.00
274	MAX FLOW TIME	The time when Max Flow Rate (item 273) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
275	MAX FLOW DATE	The date when Max Flow Rate (item 273) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
276	MAX FLOW PRESS	The PCor Gas Pressure (item 008) when Max Flow Rate (item 273) occurred. **Default** = 0.00
277	MAX HOUR CORVOL	The highest value of Peak Hour Corvol (item 211) since the last manual reset. **Default** = 00000000
278	MAX HR END TIME	Ending hour when Max Hour Corvol (item 277) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
279	MAX HOUR DATE	The date for Max Hour End Time (278) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
280	MAX HOUR PRESS	The PCor Gas Pressure (item 008) when the Max Hour Corvol (item 277) occurred. **Default** = 0.00

Item No.	Item Name	Description
281	MAX DIAL RATE	The highest value of Inst Dial Rate (item 218) since the last manual reset. **Default** = 0
282	MAX DIAL TIME	The time when Max Dial Rate (item 281) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
283	MAX DIAL DATE	The date when Max Dial Rate (item 281) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
284	MAX DIAL PRESS	The PCor Gas Pressure (item 008) when the Max Dial Rate (item 281) occurred. **Default** = 0.00
285	PCOR MAX PRESS	The highest value of PCor Gas Pressure (item 008) since the last manual reset. **Default** = 0.00
286	PCOR MAX PRESS TIME	The time when PCor Max Press (item 285) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
287	PCOR MAX PRESS DATE	The date when PCor Max Press (item 285) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
288	MAX P FLOW RATE	The Inst Flow Rate (item 209) when the PCor Max Press (item 285) occurred. **Default** = 0.00
289	PCOR MIN PRESS	The lowest value of PCor Gas Pressure (item 008) since the last manual reset. **Default** = 99999.99
290	PCOR MIN PRESS TIME	The time when PCor Min Press (item 289) occurred **Default** = 00 00 00 (Format: HH:MM:SS)
291	PCOR MIN PRESS DATE	The date when PCor Min Press (item 289) occurred. Format: Determined by item 262 **Default** = 01-01-98
292	MIN FLOW RATE	The Inst Flow Rate (item 209) when the PCor Min Press (item 289) occurred. **Default** = 0.00

Item No.	Item Name	Description
293	MAX GAS TEMP	The highest value of Gas Temperature (item 026) since the last manual reset. **Default** = -40.00
294	MAX TEMP TIME	The time when the Max Gas Temp (item 293) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
295	MAX TEMP DATE	The date when the Max Gas Temp (item 293) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
296	MAX T FLOW RATE	The Inst Flow Rate (item 209) when the Max Gas Temp (item 293) occurred. **Default** = 0.00
297	MIN GAS TEMP	The lowest value of Gas Temperature (item 026) since the last manual reset. **Default** = 99999.99
298	MIN TEMP TIME	The time when the Min Gas Temp (item 297) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
299	MIN TEMP DATE	The date when the Min Gas Temp (item 297) occurred. Date Format: Determined by item 262 **Default** = 01-01-98
300	MIN T FLOW RATE	The Inst Flow Rate (item 209) when the Min Gas Temp (item 297) occurred. **Default** = 0.00

Item No.	Item Name	Description	
301	PCOR COMP COEFF 1	**Default** = 0.000000	
302	PCOR COMP COEFF 2	**Default** = 30.00000	
303	PCOR COMP COEFF 3	**Default** = 0.000000	
304	PCOR COMP COEFF 4	**Default** = 0.000000	
305	PCOR COMP COEFF 5	**Default** = 0.000000	
306	PCOR COMP COEFF 6	**Default** = 30.00000	
307	PCOR COMP COEFF 7	**Default** = 0.000000	**These are Default**
308	PCOR COMP COEFF 8	**Default** = 0.000000	**values only.**
309	PCOR COMP COEFF 9	**Default** = 0.000000	
310	PCOR COMP COEFF 10	**Default** = 30.00000	
311	PCOR COMP COEFF 11	**Default** = 0.000000	
312	PCOR COMP COEFF 12	**Default** = 0.000000	
313	PCOR COMP COEFF 13	**Default** = 0.000000	
314	PCOR COMP COEFF 14	**Default** = 30.00000	
315	PCOR COMP COEFF 15	**Default** = 0.000000	
316	PCOR COMP COEFF 16	**Default** = 0.000000	
317	PCOR COMP COEFF 17	**Default** = 0.000000	
318	PCOR COMP COEFF 18	**Default** = 30.00000	
319	PCOR COMP COEFF 19	**Default** = 0.000000	
320	PCOR COMP COEFF 20	**Default** = 0.000000	
321	PCOR COMP COEFF 21	**Default** = 0.000000	
322	PCOR COMP COEFF 22	**Default** = 30.00000	
323	PCOR COMP COEFF 23	**Default** = 0.000000	**See information**
324	PCOR COMP COEFF 24	**Default** = 0.000000	**below for more**
325	PCOR COMP COEFF 25	**Default** = 0.000000	**details.**
326	PCOR COMP COEFF 26	**Default** = 30.00000	
327	PCOR COMP COEFF 27	**Default** = 0.000000	
328	PCOR COMP COEFF 28	**Default** = 0.000000	
329	PCOR COMP COEFF 29	**Default** = 0.000000	
330	PCOR COMP COEFF 30	**Default** = 30.00000	
331	PCOR COMP COEFF 31	**Default** = 0.000000	
332	PCOR COMP COEFF 32	**Default** = 0.000000	

Item codes 301 thru 332 are the 32 PCor pressure transducer compensation coefficients. These values determine the pressure response over the entire operating temperature range and are unique for each pressure transducer, regardless of the pressure range. The coefficient values are determined by Mercury Instruments at the factory.

Note: A Mini-AT will **not** measure pressure accurately if the default coefficients are used.

Item No.	Item Name	Description
333	CALL-IN TRIGGER	Selection to determine what activity will cause an instrument call-in. Select: **0** - No Call-in **1** - Alarm Call-in only **Default** **2** - Scheduled Call-in only **3** - Alarm & Scheduled Call-In
334	SCH CALL-IN DATE	Date of next scheduled call-in. This must be reset by the host software after each call. **Default =** 01-01-00
335	SCH CALL-IN TIME	Time of next scheduled call-in. Can be reset by host software or reused for next call-in. **Default** = 01:00:00
338	SCH CALL-IN ALARM	Status of scheduled call-in activity. '11111111' indicates call-in activity since last interrogation and intended to be reset to zero after each read. '00000000' indicates no activity since last interrogation. **Default** = 00000000
339	SCH CALL-IN PHONE#	Phone number used for scheduled call-in.

Item No.	Item Name	Description	
341	P LOG COMP COEFF 1	**Default** = 0.000000	
342	P LOG COMP COEFF 2	**Default** = 30.00000	
343	P LOG COMP COEFF 3	**Default** = 0.000000	
344	P LOG COMP COEFF 4	**Default** = 0.000000	
345	P LOG COMP COEFF 5	**Default** = 0.000000	
346	P LOG COMP COEFF 6	**Default** = 30.00000	
347	P LOG COMP COEFF 7	**Default** = 0.000000	**These are Default**
348	P LOG COMP COEFF 8	**Default** = 0.000000	**values only.**
349	P LOG COMP COEFF 9	**Default** = 0.000000	
350	P LOG COMP COEFF 10	**Default** = 30.00000	
351	P LOG COMP COEFF 11	**Default** = 0.000000	
352	P LOG COMP COEFF 12	**Default** = 0.000000	
353	P LOG COMP COEFF 13	**Default** = 0.000000	
354	P LOG COMP COEFF 14	**Default** = 30.00000	
355	P LOG COMP COEFF 15	**Default** = 0.000000	
356	P LOG COMP COEFF 16	**Default** = 0.000000	
357	P LOG COMP COEFF 17	**Default** = 0.000000	
358	P LOG COMP COEFF 18	**Default** = 30.00000	
359	P LOG COMP COEFF 19	**Default** = 0.000000	
360	P LOG COMP COEFF 20	**Default** = 0.000000	
361	P LOG COMP COEFF 21	**Default** = 0.000000	
362	P LOG COMP COEFF 22	**Default** = 30.00000	
363	P LOG COMP COEFF 23	**Default** = 0.000000	**See information**
364	P LOG COMP COEFF 24	**Default** = 0.000000	**below for more**
365	P LOG COMP COEFF 25	**Default** = 0.000000	**details.**
366	P LOG COMP COEFF 26	**Default** = 30.00000	
367	P LOG COMP COEFF 27	**Default** = 0.000000	
368	P LOG COMP COEFF 28	**Default** = 0.000000	
369	P LOG COMP COEFF 29	**Default** = 0.000000	
370	P LOG COMP COEFF 30	**Default** = 30.00000	
371	P LOG COMP COEFF 31	**Default** = 0.000000	
372	P LOG COMP COEFF 32	**Default** = 0.000000	

Item codes 341 thru 372 are the 32 PLog pressure transducer compensation coefficients. These values determine the pressure response over the entire operating temperature range and are unique for each pressure transducer, regardless of the pressure range. The coefficient values are determined by Mercury Instruments at the factory.

Note: A Mini-AT will **not** measure pressure accurately if the default coefficients are used.

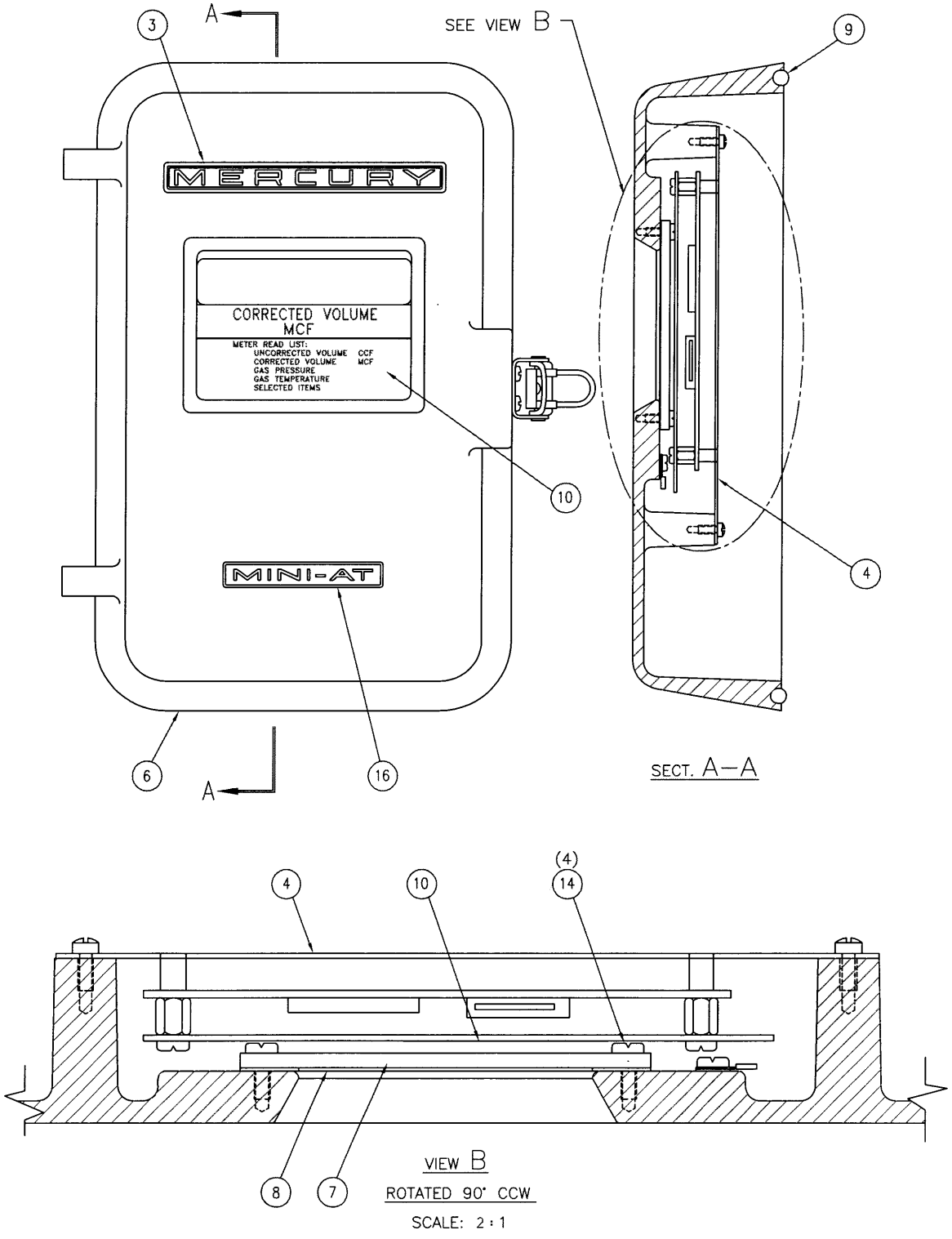
Item No.	Item Name	Description
399	RATE LOW LIMIT	Limit for Low Flow Rate Alarm (item 461). **Default** = 0.0
400	INSTRUMENT CONFIG	Item to enable or disable Plog Pressure Logging. Select: **2** - PLog off **Default** **6** - PLog on
401	PLOG SAMPLE INTVL.	Selection for the number of seconds between timed wakeups to obtain PLog pressure readings. Select: **0** - 60 Seconds **1** - 30 Seconds **2** - 15 Seconds **3** - 10 Seconds **4** - 5 Seconds
407	PLOG XDUCER TYPE	Item to select if PLog transducer is gauge or absolute type. Select: **0** - Gauge **Default** **1** - Absolute
408	PLOG PRESSURE UNITS	Code (**0-9**) that selects the unit of measurement for PLog Gas Pressure (420) and other PLog pressure related items. Select: **0** - PSIG--**Default** **5** - mBAR **1** - PSIA **6** - KGcm2 **2** - kPa **7** - inWC **3** - mPa **8** - inHg **4** - BAR **9** - mmHg
409	PLOG PRESS DISP RES	Code (**0-4**) that selects the number of decimal positions to the right of decimal point for item 420 and other PLog pressure related items. Select: **0** - x x x x x x x x **1** - x x x x x x x.x **2** - x x x x x x.x x **3** - x x x x x.x x x **4** - x x x x.x x x x
410	PLOG CAL DATE	Date of the most recent change to PLog CAL ZERO (Item 414). The date is automatically inserted into item 410 when exiting the PLog CAL ZERO calibration function. **Default** = 01-01-98
411	PLOG XDUCER SER#	Serial number of the PLog pressure transducer (printed on the transducer label), manually inserted at the factory. Note: forcing Factory Defaults will **not** change the value of this item. **Default** = 00000000

Item No.	Item Name	Description
412	PLOG TRANSDUCER RGE	The upper range limit of the PLog pressure transducer, always expressed in PSI. **Default** = 100.00
413	PLOG REF PRESS #1	The PLog pressure value used during the most recent PLog ZERO calibration. **Default** = 0.00
414	PLOG CAL ZERO	The most recent offset value for the PLog pressure transducer, obtained during a PLog Zero calibration. The value is normally very close to 0.0000 and is recalculated during each PLog Pressure Zero calibration. **Default** = 0.0000
415	1 PREV PLOG CAL ZERO	The previous value of item 414, updated on each PLog Pressure Zero Calibration. **Default** = 0.0000
416	PLOG REF PRESS #2	The PLog pressure value used during the most recent PLog SPAN calibration. **Default** = 0.00
417	PLOG CAL SPAN	The most recent span value for the PLog pressure transducer obtained during a PLog Span calibration. The value is normally very close to 1.0000 and is recalculated during each PLog Pressure Span Calibration. **Default** = 1.0000
418	1 PREV PLOG CAL SPAN	The previous value of item 417, updated on each PLog Pressure Span Calibration. **Default** = 1.0000
419	PLOG XDCR RANGE	The upper PLog pressure limit, automatically scaled to the pressure units selected at item 408. If PSI is the selected pressure units, then item 419 will be the same as item 412. Note; the value at item 419 may be manually edited to a rounded-off number, if desired. **Default** = 100.00
420	PLOG GAS PRESSURE	PLog gas pressure measured at the last wake-up. The pressure value is scaled to the unit of pressure measurement selected at item 408 and displayed with the appropriate number of decimal positions as selected at item 420.

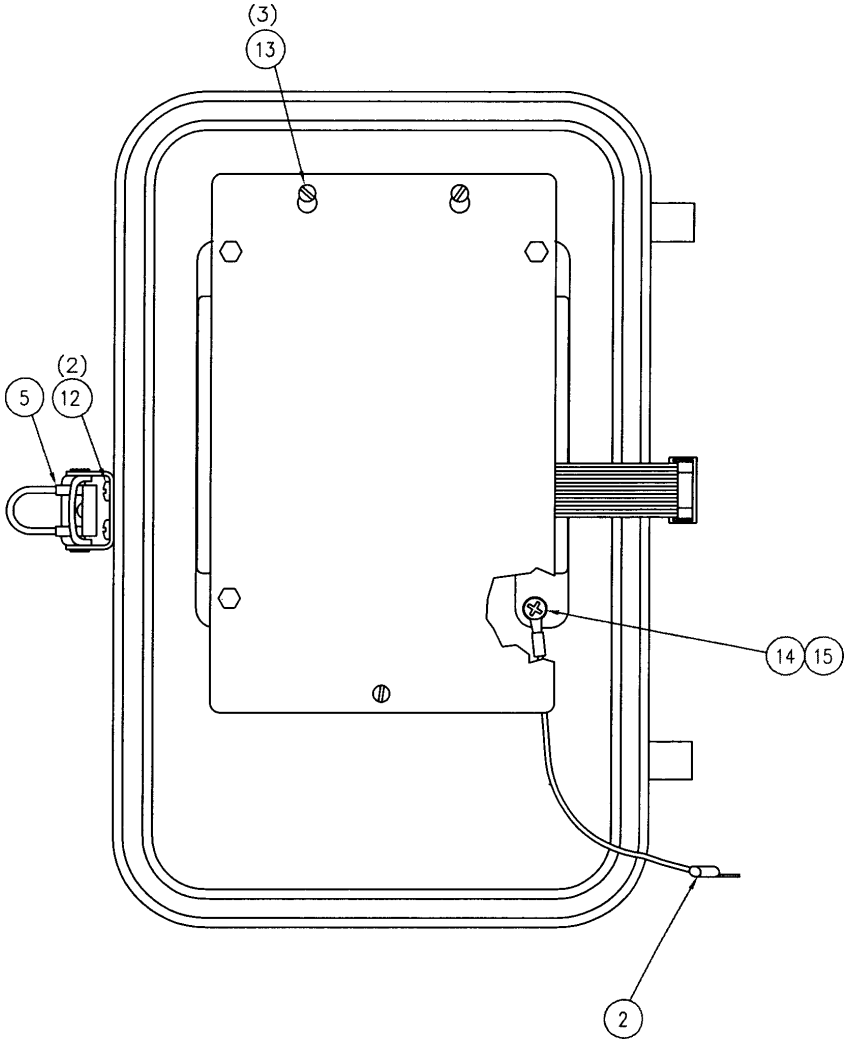
Item No.	Item Name	Description
421	PLOG AVG PRESS	Calculated PLog average pressure for the time interval selected at item 202. The average value is time weighted over the PLog SAMPLE INTERVAL selected at item 401. **Default** = 0.00
422	INTVL PLOG P HIGH	Highest PLog Gas Pressure (item 420) measured during the Time Interval selected at item 202. The value at item 422 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = 0.00
423	INTVL PLOG P LOW	Lowest PLog Gas Pressure (item 420) measured during the Time Interval selected at item 202. The value at item 422 is initialized (re-zeroed) at the beginning of each new log interval. **Default** = 099999.99
426	PLOG MAX PRESS	The highest value of PLog Gas Pressure since the last manual reset. **Default** = 0.00
427	PLOG MAX PRESS TIME	The time when PLog MAX PRESS (item 426) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
428	PLOG MAX PRESS DATE	The date when PLog MAX PRESS (item 426) occurred. **Default** = 01-01-98
429	PLOG MIN PRESS	The lowest value of PLog Gas Pressure since the last manual reset. **Default** = 99999.99
430	PLOG MIN PRESS TIME	The time when PLog MIN PRESS (item 429) occurred. **Default** = 00 00 00 (Format: HH:MM:SS)
431	PLOG MIN PRESS DATE	The date when PLog MIN PRESS (item 429) occurred. **Default** = 01-01-98

Item No.	Item Name	Description
451	PLOG PRESSURE HIGH	This item indicates if a PLog high pressure alarm was generated. During a PLog sample (Item 401), if the measurement for item 420 (PLog GAS PRESSURE) is greater than the value entered at item 455 (PLog PRESS HILIM), an alarm is initiated and is indicated by placing dots on the LCD and '11111111' at item 451. '00000000' at item 451 indicates there is no PLog pressure high alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX is enabled. The PLog Pressure High Limit value (item 455) is user selectable and is normally set somewhere between 50 and 100% of transducer range. **Default** = 00000000
452	PLOG PRESSURE LOW	This item indicates if a PLog low pressure alarm was generated. During a PLog sample (Item 401), if the measurement for item 420 (PLog GAS PRESSURE) is a value less than the value entered at item 456 (PLogPRESS LOLIM), an alarm is initiated and is indicated by placing dots on the LCD and '11111111' at item 452. '00000000' at item 452 indicates there is no PLog pressure low alarm. The alarm indicators will remain active until manually cleared (by software) or automatically when RBX is enabled. The PLog Pressure Low Limit value (item 456) is user selectable and is normally set somewhere between 0 and 50% of transducer range. **Default** = 00000000
455	PLOG PRESS HILIM	High limit for PLog pressure, initiates alarm (item 451), if exceeded by item 420. **Default** = 099999.99
456	PLOG PRESS LOLIM	Low limit for PLog pressure, initiates alarm (item 452), if higher than item 420. **Default** = 0.00
459	PLOG PRESS DEADBAND	A hysteresis band that provides a buffer below the PLog Pressure Hi limit (item 455) and above the PLog Pressure Lo limit (item 456) when alarms are automatically cleared by RBX operation. The user-specified value determines the magnitude of the band. The PLog pressure measurement (item 420) must pass completely through the dead band before the pressure alarm is automatically cleared. **Default** = 5.00 PSIG

Item No.	Item Name	Description
460	ZERO RATE DETECTION	Parameter to disable/enable zero flow rate detection as well as apply a scaling factor to the calculated expectation time period. A value of '0' disables Zero-Flow Detection. A value greater than zero will enable Zero-Flow Detection. Range: 0 to 60 **Default =** 2
461	RATE LOW ALARM	This item indicates if a Low Flow Rate alarm was generated. If the value calculated at item 209 was less than the value entered at item 462, an alarm is initiated and is indicated by placing dots on the LCD and "11111111" at item 461. "00000000" at item 461 indicates there is no Low Flow Alarm. The alarm indicators will remain active until manually cleared or automatically when RBX is enabled. This alarm can be disabled by setting the value at item 462 to "0.0". **Default =** 00000000
482	DEFAULT DISPLAY	Parameter used to select which item will be displayed on the LCD when the instrument is in corrector mode. Any item may be selected, but traditionally corrected volume is displayed **Default** = 000 (Corrected Volume)
486	MODEM AT ENABLE	Selection to determine the type of call-in initiated by the instrument. Select: **0**-Call-in via Alarm Pulse **Default** **1**-Call-in via AT commands
491	MODEM INIT STRING	Character string used to initialize instrument modem at the beginning of call-in. **Default** = &f
492	MODEM DIAL STRING	Character string used to initiate dialing **Default** = ATDT
493	ALARM CALL-IN #	Telephone number dialed when Alarm call-in is executed.
494	MODEM HANG-UP	Character string used by to disconnectmodem communications **Default** = ATH
495	MDM RETRY INTVL A	Retry period A, in minutes. Intended to be the primary retry. **Default** = 5
496	MDM RETRY INTVL B	Retry period B, in minutes. Intended to be the secondary retry. **Default** = 1440
497	MDM RETRY COUNT A	Number of period A retries **Default** = 3

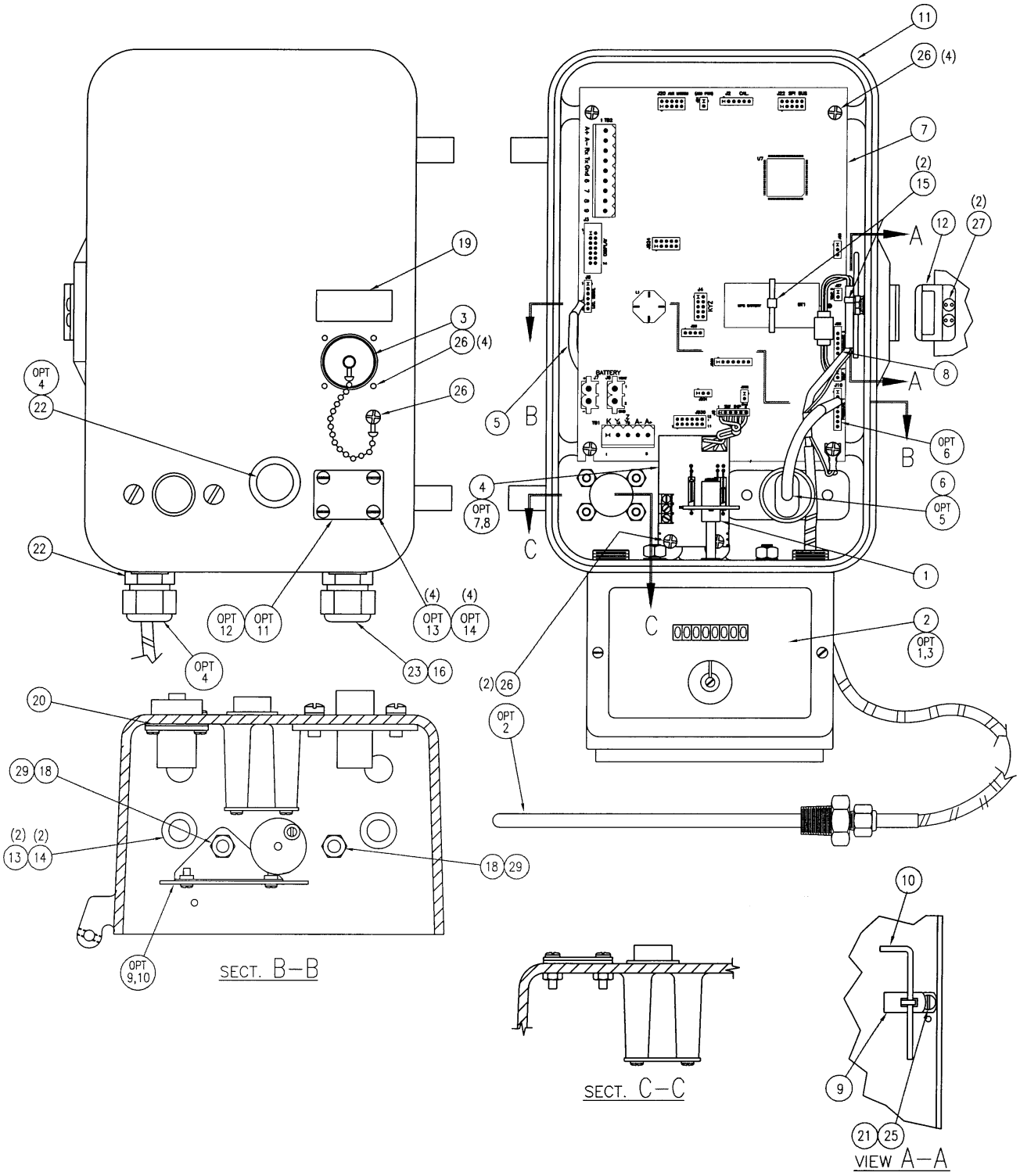

3
A
SEE VIEW B
9
MERCURY
CORRECTED VOLUME
MCF
METER READ LIST:
UNCORRECTED VOLUME CCF
CORRECTED VOLUME MCF
GAS PRESSURE
GAS TEMPERATURE
SELECTED ITEMS
10
4
MINI-AT
6
16
A
SECT. A—A
4
10
(4)
14
8
7
VIEW B
ROTATED 90° CCW
SCALE: 2 : 1

Mini-AT Door



Mini-AT Door Parts List			
Item	Qty	Part #	Description
1			
2	1	40-2013	Ground Wire Assembly
3	1	20-8283	Nameplate Assembly
4	1	20-8746	Window Display Assembly
5	1	20-4295	Latch, w/Hasp
6	1	20-8788	Door, Drilled
7	1	20-8285	Window, Lexan
8	1	20-8286	Gasket, Window
9	1	20-2196	Gasket, Door
10	1	20-8330	Label, MCF/CCF
11			
12	1	60-1228	Screw, BD #6-32 x 1/2
13	2	60-1241	Screw, Fil #6-32 x 7/16 Self Tap
14	3	60-1249	Screw, Pan #6-32 x 5/16 S.T. Phillips
15	5	20-8204	Washer, #6 Ext Lock
16	1	20-8961	Nameplate, Mini-AT

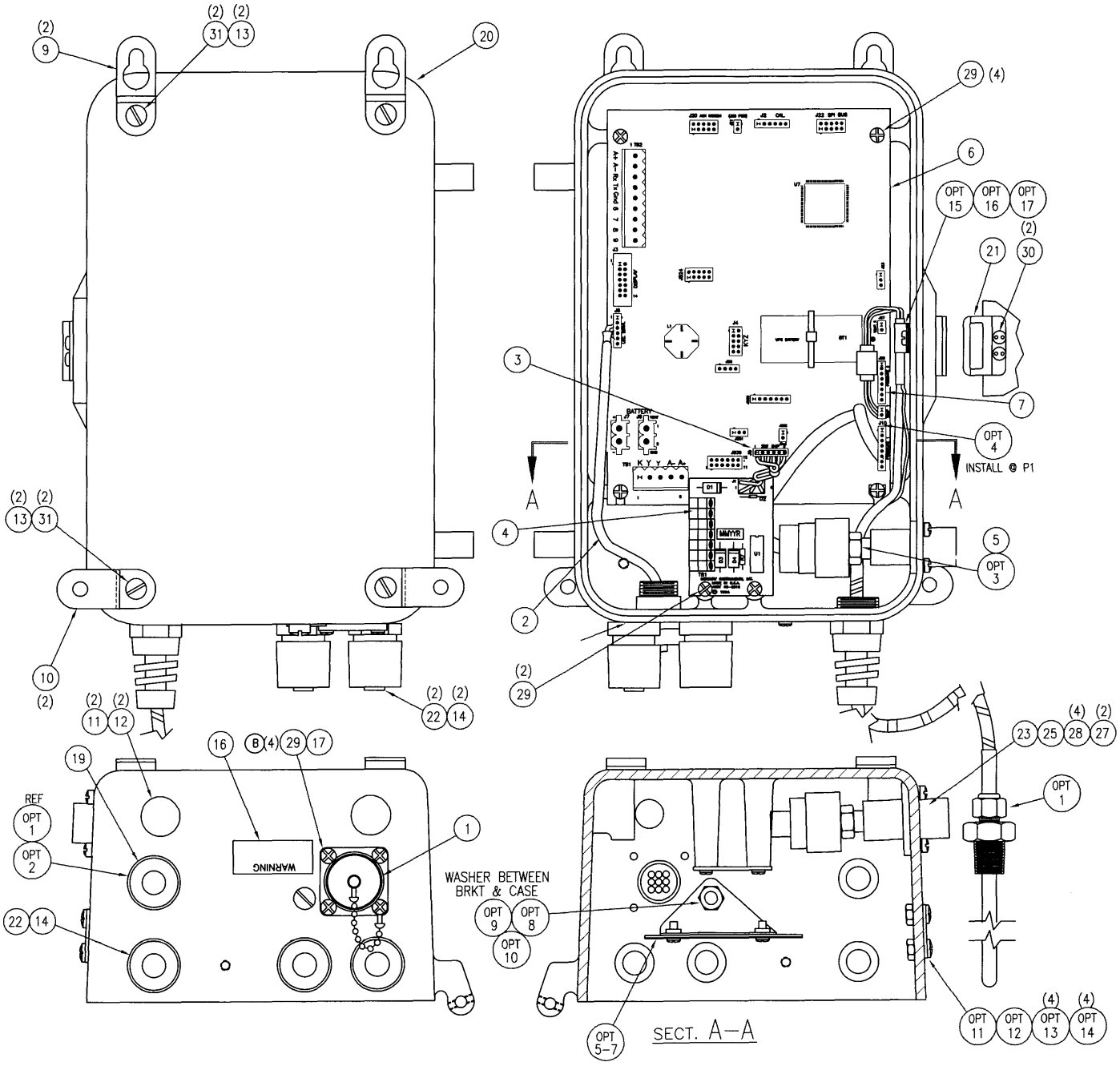
Mini-AT Door **Options**			
Item	Qty	Part #	Description
1	1	Call M.I.	Label, Window
2	1	20-4215	Latch, w/o Hasp



Meter Mount Mini-AT

Mini-AT **Meter Mount** Parts List			
Item	Qty	Part #	Description
1	1	20-6882	Magnetic Disc Assembly
2	1	20-7283	U.M.B. Assembly
3	1	40-1576	Cap & Chain Assembly
4	1	40-1699-3	Input Switch Board
5	1	40-1728	Cable, Internal RS-232
6	1	40-2041	Transducer Assembly
7	1	40-2335	Mainboard
8	1	40-2112	Pressure Terminator
9	1	20-1009	Clip
10	1	20-1428	Wrench, Bristol
11	1	20-8925	Case, Drilled
12	1	20-8689	Plate, Bent Strike
13	2	20-2191	Vent
14	2	20-3737	Filter
15	2	20-3827	Cable Tie
16	1	20-7289	Plug, Strain Relief 5/16 dia
17			
18	2	20-7469	Washer, #1/4 Int Lock
19	1	20-8087	Label, Warning DCU Jack
20	1	20-8196	Gasket, RS-232 Case Connector
21	1	20-8204	Washer, #6 Ext Lock
22	2	20-8312	Plug, 1/2 NPT
23	1	20-8911	Fitting, Strain Relief .20-.35
24			
25	1	60-1202	Screw, Bd #6-32 x 3/16
26	11	60-1249	Screw, PN #6-32 x 5/16 Self Tap
27	2	60-1247	Screw, Spanner #6-32 x 5/16
28			
29	2	60-1607	Nut, Hex #1/4-20
30			

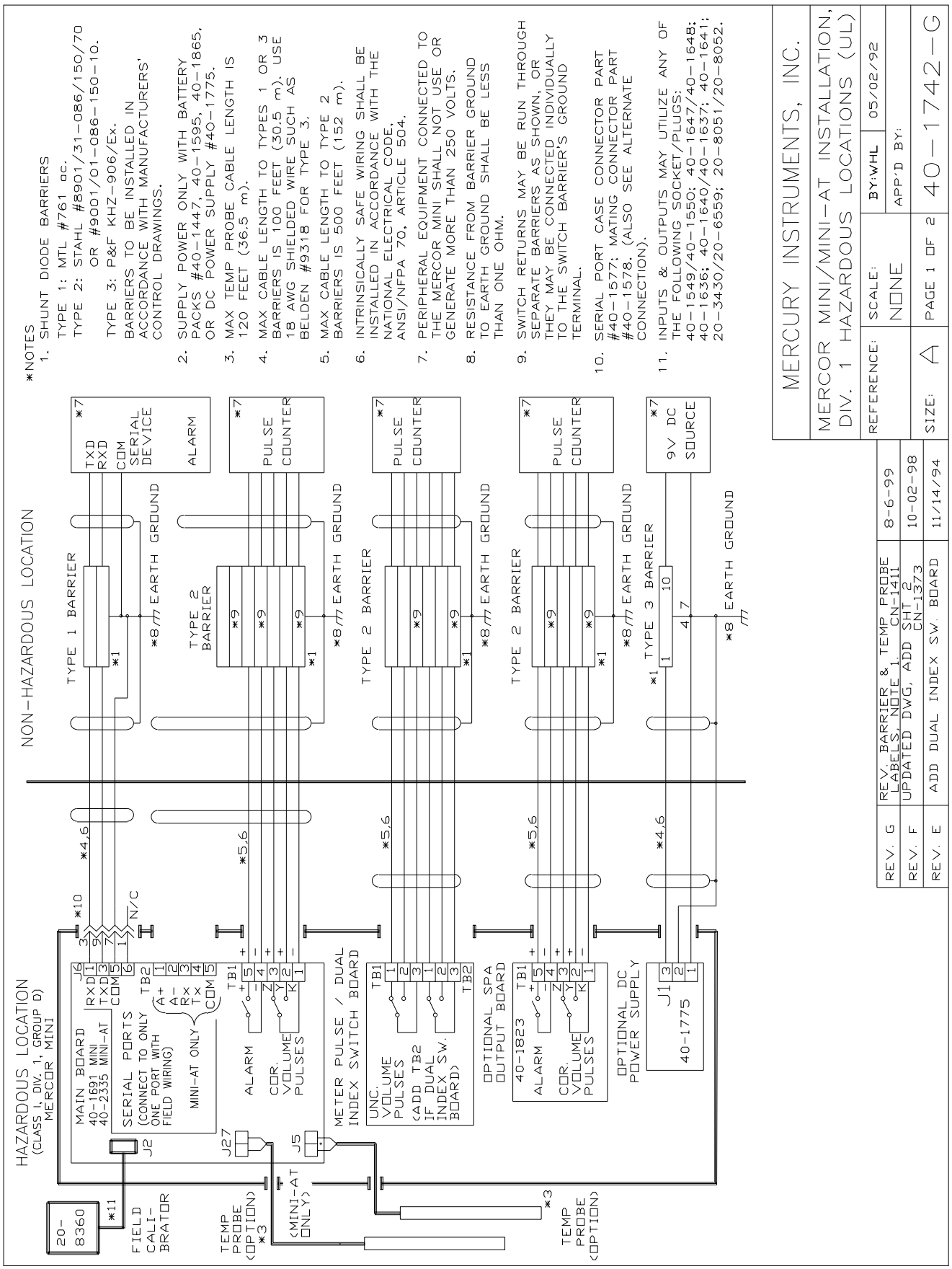
Mini-AT **Meter Mount Options**			
Item	Qty	Part #	Description
1	1	20-7558	Optional Indexes
2	1	20-8124	Optional Temperature Probes
3	1	20-8513	Adapter Assembly, 1" Union
4	1	20-8911	Fitting, Strain Relief .20-.35
5	1	40-1428	Optional Pressure Transducers
6	1	40-2112	Pressure Terminator Assembly
7	1	40-1962	Dual Index Switch Board Assembly
8	1	40-2061	Remote Switch Interface Board
9	1	40-2063	Single Pulse Alarm Board
10	1	40-2093	High Frequency Input Board
11	1	20-8978	Plate, Cover - 2nd Pressure
12	1	20-8981	Gasket, 2nd Pressure
13	4	60-1322	Screw, Bd #8-32 x 5/8
14	4	60-1605	Nut, Hex #8-32
15			

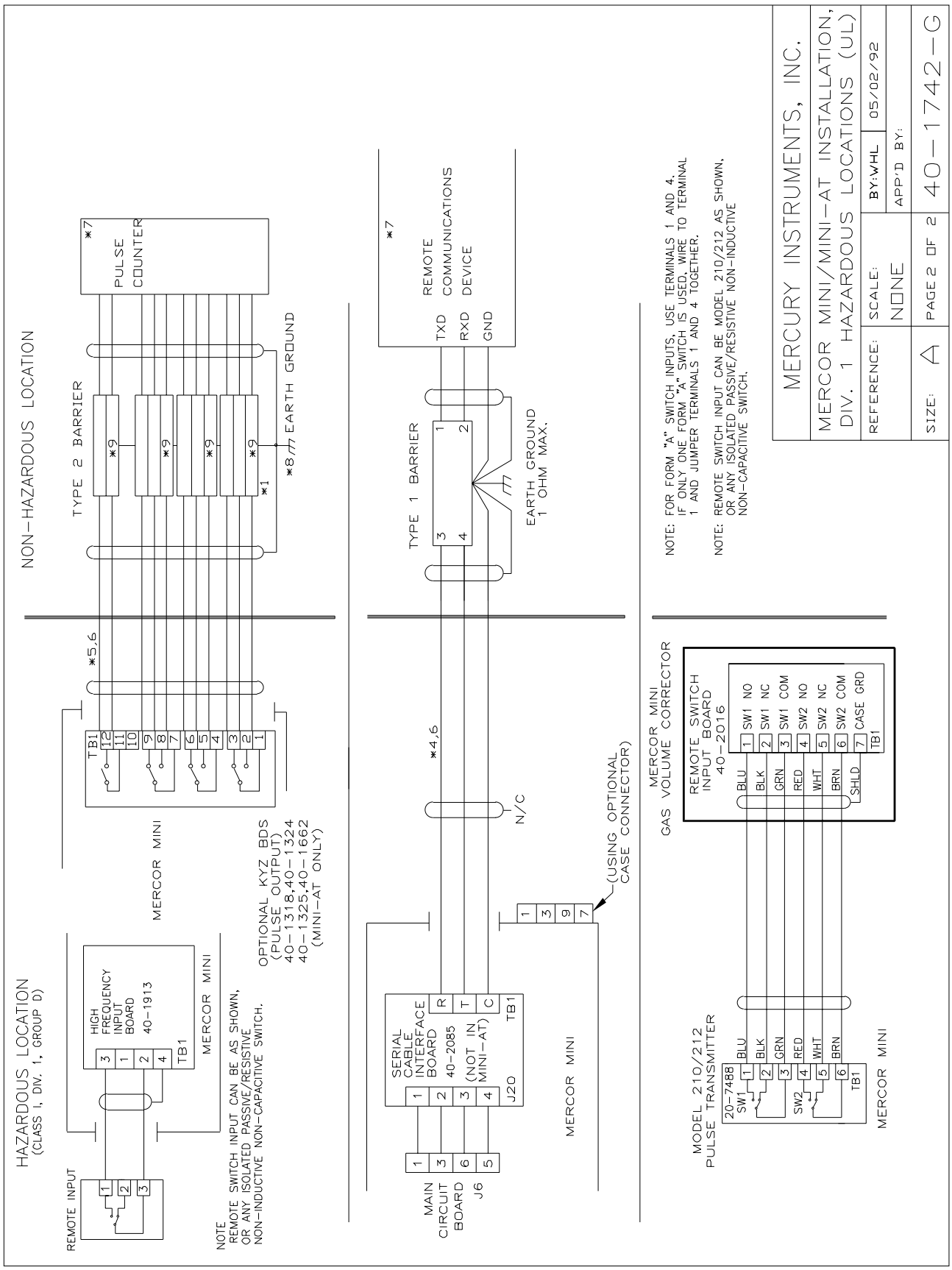


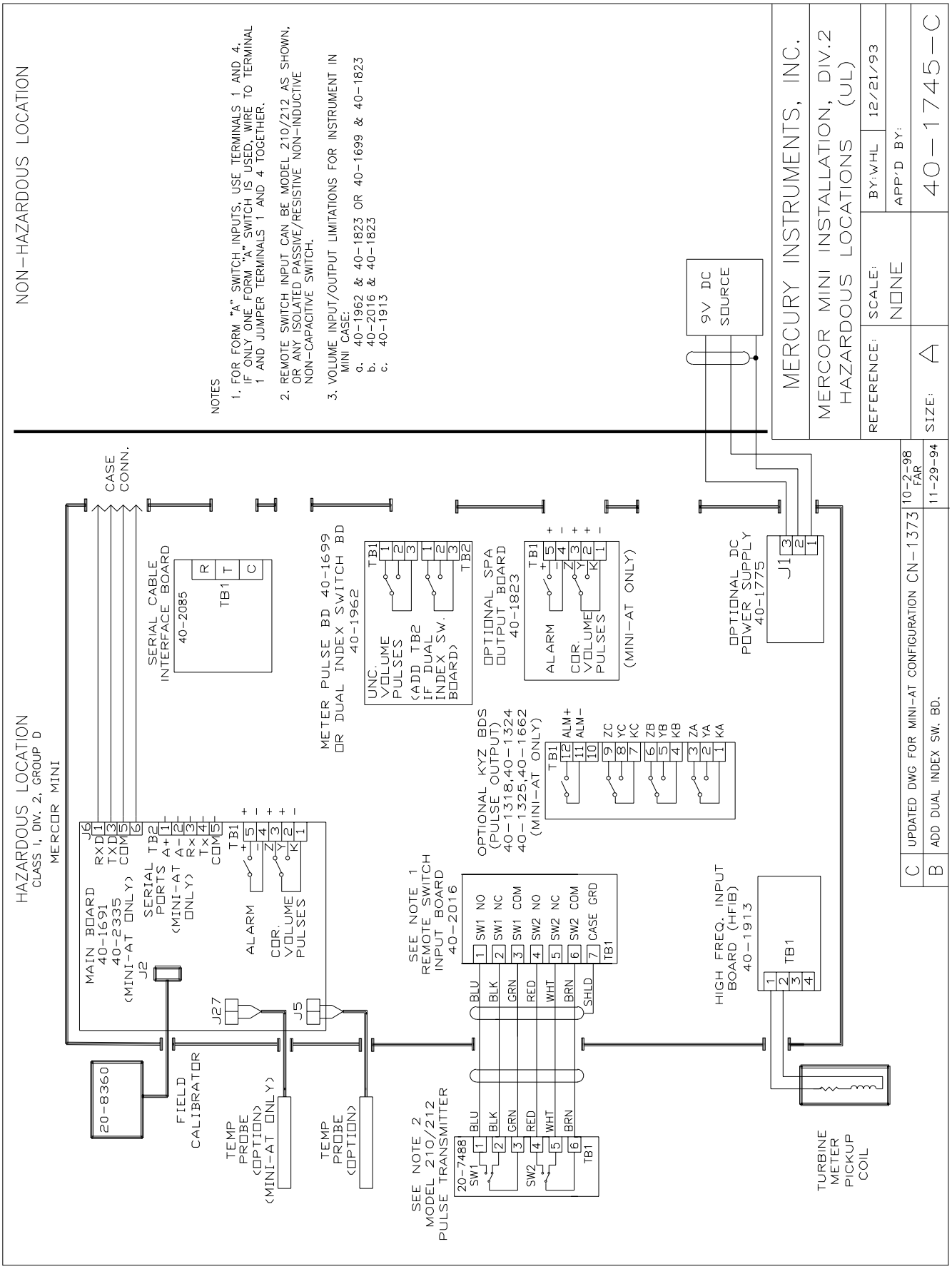
Wall Mount Mini-AT

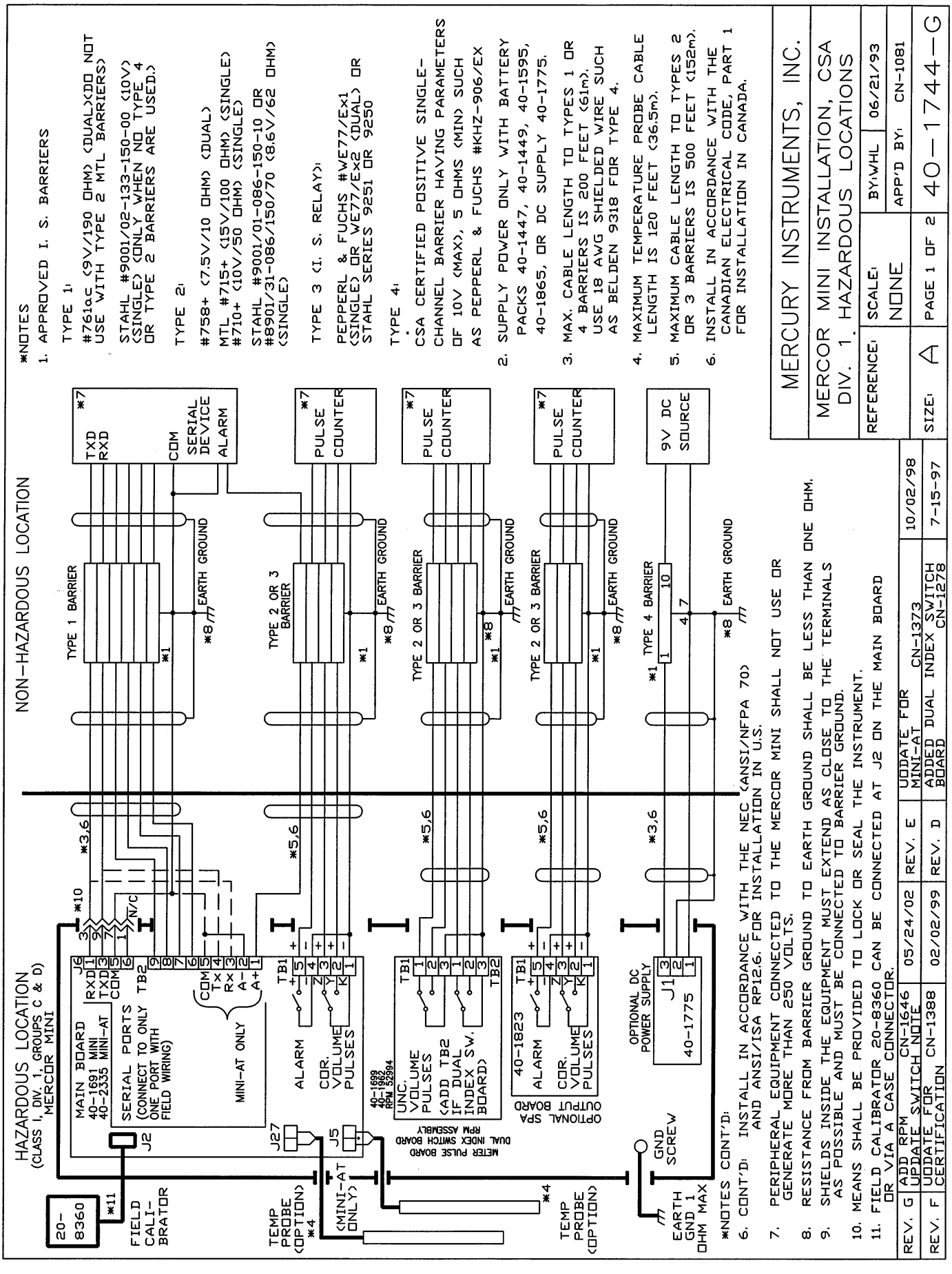
Mini-AT **Wall Mount** Parts List			
Item	Qty	Part #	Description
1	1	40-1576	Cap & Chain Assembly
2	1	40-1728	Cable, Internal RS-232
3	1	40-1939	Cable, RSI Board
4	1	40-2016	Remote Switch Interface Board-Mini
5	1	40-2453	Transducer Assembly
6	1	40-2335	Mainboard
7	1	40-2112	Pressure Terminator
8	1		
9	2	20-1586	Hangar, Case Top
10	2	20-1587	Hangar, Case Bottom
11	2	20-2191	Vent
12	2	20-3737	Filter
13	4	20-5300	Washer, #10 Ext Lock
14	3	20-7289	Plug, Strain Relief 5/16 dia
15	-	20-7380	Adhesive, #732 Silicone
16	1	20-8087	Label, Warning DCU Jack
17	1	20-8196	Gasket, RS-232 Case Connector
18			
19	1	20-8312	Plug, 1/2 NPT
20	1	20-9021	Case, Drilled Mini-AT Wall Mount
21	1	20-8689	Plate, Bent Strike
22	2	20-8911	Fitting, Strain Relief .20-.35
23	1	20-8980	Connector, Case
24			
25	1	20-8981	Gasket, Case Connector
26			
27	2	20-8159	Washer, #8 Int Tooth Lock
28	4	60-1303	Screw, Fil Hd #8-32 x 3/8
29	10	60-1249	Screw, PN #6-32 x 5/16 Self Tap
30	2	60-1247	Screw, Spanner #6-32 x 5/16
31	4	60-1353	Screw, Bd Hd #10-32 x 5/16
32			

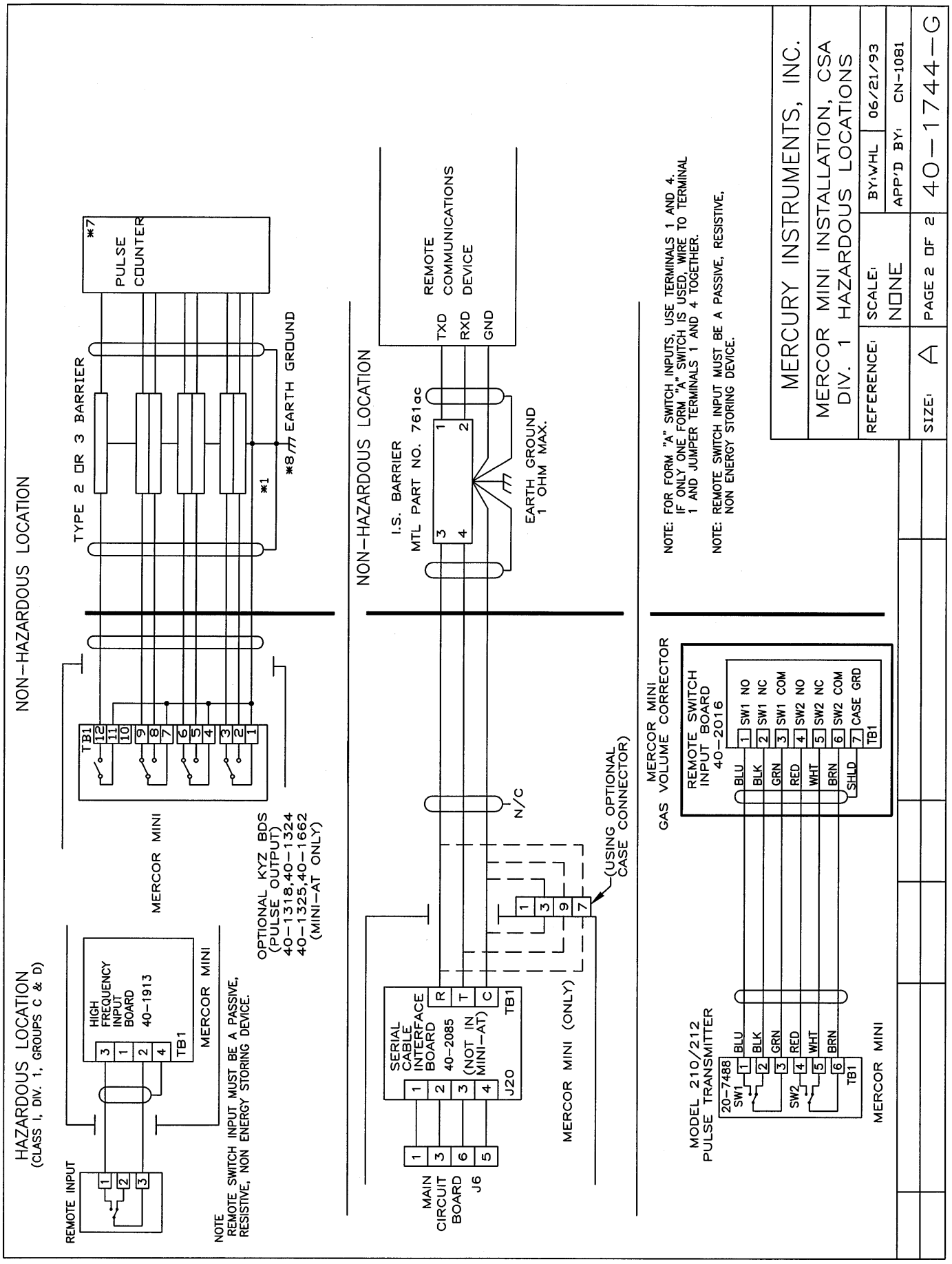
Mini-AT **Wall Mount Options**			
Item	Qty	Part #	Description
1	1	20-8124	Optional Temperature Probes
2	1	20-8912	Fitting, Flex Strain Relief .20-.35
3	1	40-1428	Optional Pressure Transducers
4	1	40-2112	Pressure Terminator Assembly
5	1	40-2063	Single Pulse Alarm Board
6	1	40-2093	High Frequency Input Board
7	1	40-2094	Serial Cable Interface Board
8	1	60-1413	Screw, Fil 1/4 x 3/8
9	1	60-1607	Nut, Hex 1/4-20
10	1	20-7549	Washer, 1/4 Int Lock
11	1	20-8978	Plate, Cover - 2nd Pressure
12	1	20-8981	Gasket, 2nd Pressure
13	4	60-1322	Screw, Bd #8-32 x 5/8
14	4	60-1605	Nut, Hex #8-32
15	1	40-1649	Clamp, 3/16 Cable
16	1	60-1202	Screw, Bd #6-32 x 3/16
17	1	20-8204	Washer, #6 Ext Lock


*NOTES
1. SHUNT DIODE BARRIERS
TYPE 1: MTL #761 ac.
TYPE 2: STAHL #8901/31-086/150/70 OR #9001/01-086-150-10.
TYPE 3: P&F KHZ-906/Ex.
BARRIERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS' CONTROL DRAWINGS.
2. SUPPLY POWER ONLY WITH BATTERY PACKS #40-1447, 40-1595, 40-1865, OR DC POWER SUPPLY #40-1775.
3. MAX TEMP PROBE CABLE LENGTH IS 120 FEET (36.5 m).
4. MAX CABLE LENGTH TO TYPES 1 OR 3 BARRIERS IS 100 FEET (30.5 m). USE 18 AWG SHIELDED WIRE SUCH AS BELDEN #9318 FOR TYPE 3.
5. MAX CABLE LENGTH TO TYPE 2 BARRIERS IS 500 FEET (152 m).
6. INTRINSICALLY SAFE WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, ANSI/NFPA 70, ARTICLE 504.
7. PERIPHERAL EQUIPMENT CONNECTED TO THE MERCOR MINI SHALL NOT USE OR GENERATE MORE THAN 250 VOLTS.
8. RESISTANCE FROM BARRIER GROUND TO EARTH GROUND SHALL BE LESS THAN ONE OHM.
9. SWITCH RETURNS MAY BE RUN THROUGH SEPARATE BARRIERS AS SHOWN, OR THEY MAY BE CONNECTED INDIVIDUALLY TO THE SWITCH BARRIER'S GROUND TERMINAL.
10. SERIAL PORT CASE CONNECTOR PART #40-1577; MATING CONNECTOR PART #40-1578. (ALSO SEE ALTERNATE CONNECTION).
11. INPUTS & OUTPUTS MAY UTILIZE ANY OF THE FOLLOWING SOCKET/PLUGS: 40-1549/40-1550; 40-1647/40-1648; 40-1636; 40-1640/40-1637; 40-1641; 20-3430/20-6559; 20-8051/20-8052.
NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUP D)
MERCOR MINI
MAIN BOARD
40-1691 MINI
40-2335 MINI-AT
SERIAL PORTS
(CONNECT TO ONLY ONE PORT WITH FIELD WIRING)
MINI-AT ONLY
TYPE 1 BARRIER
TYPE 2 BARRIER
TYPE 3 BARRIER
TXD
RXD
COM
SERIAL DEVICE
ALARM
PULSE COUNTER
9V DC SOURCE
EARTH GROUND
N/C
METER PULSE / DUAL INDEX SWITCH BOARD
UNC. VOLUME PULSES
(ADD TB2 IF DUAL INDEX SW. BOARD)
OPTIONAL SPA OUTPUT BOARD
40-1823
COR. VOLUME PULSES
OPTIONAL DC POWER SUPPLY
40-1775
FIELD CALI-BRATOR
20-8360
TEMP PROBE (OPTION)
(MINI-AT ONLY)
MERCURY INSTRUMENTS, INC.
MERCOR MINI/MINI-AT INSTALLATION, DIV. 1 HAZARDOUS LOCATIONS (UL)
REFERENCE:
SCALE: NONE
BY: WHL
05/02/92
APP'D BY:
SIZE: A
PAGE 1 OF 2
40-1742-G
REV. G REV. BARRIER & TEMP PROBE LABELS, NOTE 1. CN-1411 8-6-99
REV. F UPDATED DWG, ADD SHT 2 CN-1373 10-02-98
REV. E ADD DUAL INDEX SW. BOARD 11/14/94


NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUP D)
TYPE 2 BARRIER
*7
PULSE COUNTER
*9
*8
EARTH GROUND
*1
*5,6
TB1
MERCOR MINI
OPTIONAL KYZ BDS
(PULSE OUTPUT)
40-1318,40-1324
40-1325,40-1662
(MINI-AT ONLY)
REMOTE INPUT
HIGH FREQUENCY INPUT BOARD
40-1913
TB1
MERCOR MINI
NOTE
REMOTE SWITCH INPUT CAN BE AS SHOWN,
OR ANY ISOLATED PASSIVE/RESISTIVE
NON-INDUCTIVE NON-CAPACITIVE SWITCH.
TYPE 1 BARRIER
*7
REMOTE COMMUNICATIONS DEVICE
TXD
RXD
GND
EARTH GROUND
1 OHM MAX.
*4,6
N/C
(USING OPTIONAL CASE CONNECTOR)
SERIAL CABLE INTERFACE BOARD
40-2085
(NOT IN MINI-AT)
J20
TB1
MAIN CIRCUIT BOARD
J6
MERCOR MINI
MERCOR MINI
GAS VOLUME CORRECTOR
REMOTE SWITCH INPUT BOARD
40-2016
SW1 NO
SW1 NC
SW1 COM
SW2 NO
SW2 NC
SW2 COM
CASE GRD
SHLD
TB1
BLU
BLK
GRN
RED
WHT
BRN
MODEL 210/212
PULSE TRANSMITTER
20-7488
SW1
SW2
MERCOR MINI
NOTE: FOR FORM "A" SWITCH INPUTS, USE TERMINALS 1 AND 4.
IF ONLY ONE FORM "A" SWITCH IS USED, WIRE TO TERMINAL
1 AND JUMPER TERMINALS 1 AND 4 TOGETHER.
NOTE: REMOTE SWITCH INPUT CAN BE MODEL 210/212 AS SHOWN,
OR ANY ISOLATED PASSIVE/RESISTIVE NON-INDUCTIVE
NON-CAPACITIVE SWITCH.
MERCURY INSTRUMENTS, INC.
MERCOR MINI/MINI-AT INSTALLATION,
DIV. 1 HAZARDOUS LOCATIONS (UL)
REFERENCE:
SCALE: NONE
BY: WHL
05/02/92
APP'D BY:
SIZE: A
PAGE 2 OF 2
40-1742-G


NON-HAZARDOUS LOCATION
NOTES
1. FOR FORM "A" SWITCH INPUTS, USE TERMINALS 1 AND 4. IF ONLY ONE FORM "A" SWITCH IS USED, WIRE TO TERMINAL 1 AND JUMPER TERMINALS 1 AND 4 TOGETHER.
2. REMOTE SWITCH INPUT CAN BE MODEL 210/212 AS SHOWN, OR ANY ISOLATED PASSIVE/RESISTIVE NON-INDUCTIVE NON-CAPACITIVE SWITCH.
3. VOLUME INPUT/OUTPUT LIMITATIONS FOR INSTRUMENT IN MINI CASE:
a. 40-1962 & 40-1823 OR 40-1699 & 40-1823
b. 40-2016 & 40-1823
c. 40-1913
9V DC SOURCE
MERCURY INSTRUMENTS, INC.
MERCOR MINI INSTALLATION, DIV.2
HAZARDOUS LOCATIONS (UL)
REFERENCE:
SCALE: NONE
BY:WHL 12/21/93
APP'D BY:
SIZE: A
40-1745-C
C UPDATED DWG FOR MINI-AT CONFIGURATION CN-1373 10-2-98 FAR
B ADD DUAL INDEX SW. BD. 11-29-94
HAZARDOUS LOCATION
CLASS I, DIV. 2, GROUP D
MERCOR MINI
CASE CONN.
MAIN BOARD 40-1691 40-2335 (MINI-AT ONLY)
J6 RXD TXD COM
J2
SERIAL PORTS (MINI-AT ONLY)
TB2 A+ A- RX TX COM
SERIAL CABLE INTERFACE BOARD 40-2085
TB1 R T C
METER PULSE BD 40-1699 OR DUAL INDEX SWITCH BD 40-1962
UNC. VOLUME PULSES
(ADD TB2 IF DUAL INDEX SW. BOARD)
TB1 TB2
OPTIONAL SPA OUTPUT BOARD 40-1823
ALARM
COR. VOLUME PULSES
(MINI-AT ONLY)
OPTIONAL DC POWER SUPPLY 40-1775
J1
ALARM
COR. VOLUME PULSES
TB1
OPTIONAL KYZ BDS (PULSE OUTPUT) 40-1318,40-1324 40-1325,40-1662 (MINI-AT ONLY)
ALM+ ALM-
ZC YC KC ZB YB KB ZA YA KA
SEE NOTE 1 REMOTE SWITCH INPUT BOARD 40-2016
SW1 NO SW1 NC SW1 COM SW2 NO SW2 NC SW2 COM CASE GRD
BLU BLK GRN RED WHT BRN SHLD
HIGH FREQ. INPUT BOARD (HFIB) 40-1913
TB1
J27
J5
20-8360
FIELD CALIBRATOR
TEMP PROBE (OPTION) (MINI-AT ONLY)
TEMP PROBE (OPTION)
SEE NOTE 2 MODEL 210/212 PULSE TRANSMITTER
20-7488
SW1 SW2
TURBINE METER PICKUP COIL


NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUPS C & D)
MERCOR MINI
MAIN BOARD
40-1691 MINI
40-2335 MINI-AT
SERIAL PORTS
(CONNECT TO ONLY
ONE PORT WITH
FIELD WIRING)
MINI-AT ONLY
FIELD CALI-BRATOR
20-8360
TEMP PROBE (OPTION)
(MINI-AT ONLY)
ALARM
COR. VOLUME PULSES
UNC. VOLUME PULSES
(ADD TB2 IF DUAL INDEX SW. BOARD)
METER PULSE BOARD
DUAL INDEX SWITCH BOARD
RPM ASSEMBLY
40-1823
OPTIONAL SPA OUTPUT BOARD
OPTIONAL DC POWER SUPPLY
40-1775
GND SCREW
EARTH GND 1 OHM MAX
TYPE 1 BARRIER
TYPE 2 OR 3 BARRIER
TYPE 4 BARRIER
TXD
RXD
COM
SERIAL DEVICE
ALARM
PULSE COUNTER
9V DC SOURCE
EARTH GROUND
*NOTES
1. APPROVED I. S. BARRIERS
TYPE 1:
#761ac (9V/190 OHM) (DUAL)(DO NOT USE WITH TYPE 2 MTL BARRIERS)
STAHL #9001/02-133-150-00 (10V) (SINGLE) (ONLY WHEN NO TYPE 4 OR TYPE 2 BARRIERS ARE USED.)
TYPE 2:
#758+ (7.5V/10 OHM) (DUAL)
MTL #715+ (15V/100 OHM) (SINGLE)
#710+ (10V/50 OHM) (SINGLE)
STAHL #9001/01-086-150-10 OR #8901/31-086/150/70 (8.6V/62 OHM) (SINGLE)
TYPE 3 (I. S. RELAY):
PEPPERL & FUCHS #WE77/Ex1 (SINGLE) OR WE77/Ex2 (DUAL) OR STAHL SERIES 9251 OR 9250
TYPE 4:
CSA CERTIFIED POSITIVE SINGLE-CHANNEL BARRIER HAVING PARAMETERS OF 10V (MAX), 5 OHMS (MIN) SUCH AS PEPPERL & FUCHS #KHZ-906/EX
2. SUPPLY POWER ONLY WITH BATTERY PACKS 40-1447, 40-1449, 40-1595, 40-1865, OR DC SUPPLY 40-1775.
3. MAX. CABLE LENGTH TO TYPES 1 OR 4 BARRIERS IS 200 FEET (61m). USE 18 AWG SHIELDED WIRE SUCH AS BELDEN 9318 FOR TYPE 4.
4. MAXIMUM TEMPERATURE PROBE CABLE LENGTH IS 120 FEET (36.5m).
5. MAXIMUM CABLE LENGTH TO TYPES 2 OR 3 BARRIERS IS 500 FEET (152m).
6. INSTALL IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1 FOR INSTALLATION IN CANADA.
*NOTES CONT'D:
6. CONT'D: INSTALL IN ACCORDANCE WITH THE NEC (ANSI/NFPA 70) AND ANSI/ISA RP12.6. FOR INSTALLATION IN U.S.
7. PERIPHERAL EQUIPMENT CONNECTED TO THE MERCOR MINI SHALL NOT USE OR GENERATE MORE THAN 250 VOLTS.
8. RESISTANCE FROM BARRIER GROUND TO EARTH GROUND SHALL BE LESS THAN ONE OHM.
9. SHIELDS INSIDE THE EQUIPMENT MUST EXTEND AS CLOSE TO THE TERMINALS AS POSSIBLE AND MUST BE CONNECTED TO BARRIER GROUND.
10. MEANS SHALL BE PROVIDED TO LOCK OR SEAL THE INSTRUMENT.
11. FIELD CALIBRATOR 20-8360 CAN BE CONNECTED AT J2 ON THE MAIN BOARD OR VIA A CASE CONNECTOR.
REV. G ADD RPM UPDATE SWITCH NOTE CN-1646 05/24/02 REV. E UPDATE FOR MINI-AT CN-1373 10/02/98
REV. F UPDATE FOR CERTIFICATION CN-1388 02/02/99 REV. D ADDED DUAL INDEX SWITCH BOARD CN-1278 7-15-97
MERCURY INSTRUMENTS, INC.
MERCOR MINI INSTALLATION, CSA DIV. 1, HAZARDOUS LOCATIONS
REFERENCE: SCALE: NONE BY: WHL 06/21/93
APP'D BY: CN-1081
SIZE: A PAGE 1 OF 2
40-1744-G


NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUPS C & D)
REMOTE INPUT
HIGH FREQUENCY INPUT BOARD 40-1913
TB1
MERCOR MINI
NOTE
REMOTE SWITCH INPUT MUST BE A PASSIVE, RESISTIVE, NON ENERGY STORING DEVICE.
TYPE 2 OR 3 BARRIER
*7
PULSE COUNTER
TB1
*1
*8
EARTH GROUND
MERCOR MINI
OPTIONAL KYZ BDS (PULSE OUTPUT) 40-1318,40-1324 40-1325,40-1662 (MINI-AT ONLY)
NON-HAZARDOUS LOCATION
I.S. BARRIER MTL PART NO. 761ac
REMOTE COMMUNICATIONS DEVICE
TXD
RXD
GND
EARTH GROUND 1 OHM MAX.
N/C
SERIAL CABLE INTERFACE BOARD 40-2085 (NOT IN MINI-AT)
R
T
C
TB1
J20
MAIN CIRCUIT BOARD J6
MERCOR MINI (ONLY)
(USING OPTIONAL CASE CONNECTOR)
MERCOR MINI GAS VOLUME CORRECTOR
REMOTE SWITCH INPUT BOARD 40-2016
SW1 NO
SW1 NC
SW1 COM
SW2 NO
SW2 NC
SW2 COM
CASE GRD
SHLD
TB1
BLU
BLK
GRN
RED
WHT
BRN
MODEL 210/212 PULSE TRANSMITTER
20-7488
SW1
SW2
MERCOR MINI
NOTE: FOR FORM "A" SWITCH INPUTS, USE TERMINALS 1 AND 4. IF ONLY ONE FORM "A" SWITCH IS USED, WIRE TO TERMINAL 1 AND JUMPER TERMINALS 1 AND 4 TOGETHER.
NOTE: REMOTE SWITCH INPUT MUST BE A PASSIVE, RESISTIVE, NON ENERGY STORING DEVICE.
MERCURY INSTRUMENTS, INC.
MERCOR MINI INSTALLATION, CSA DIV. 1 HAZARDOUS LOCATIONS
REFERENCE:
SCALE: NONE
BY: WHL 06/21/93
APP'D BY: CN-1081
SIZE: A
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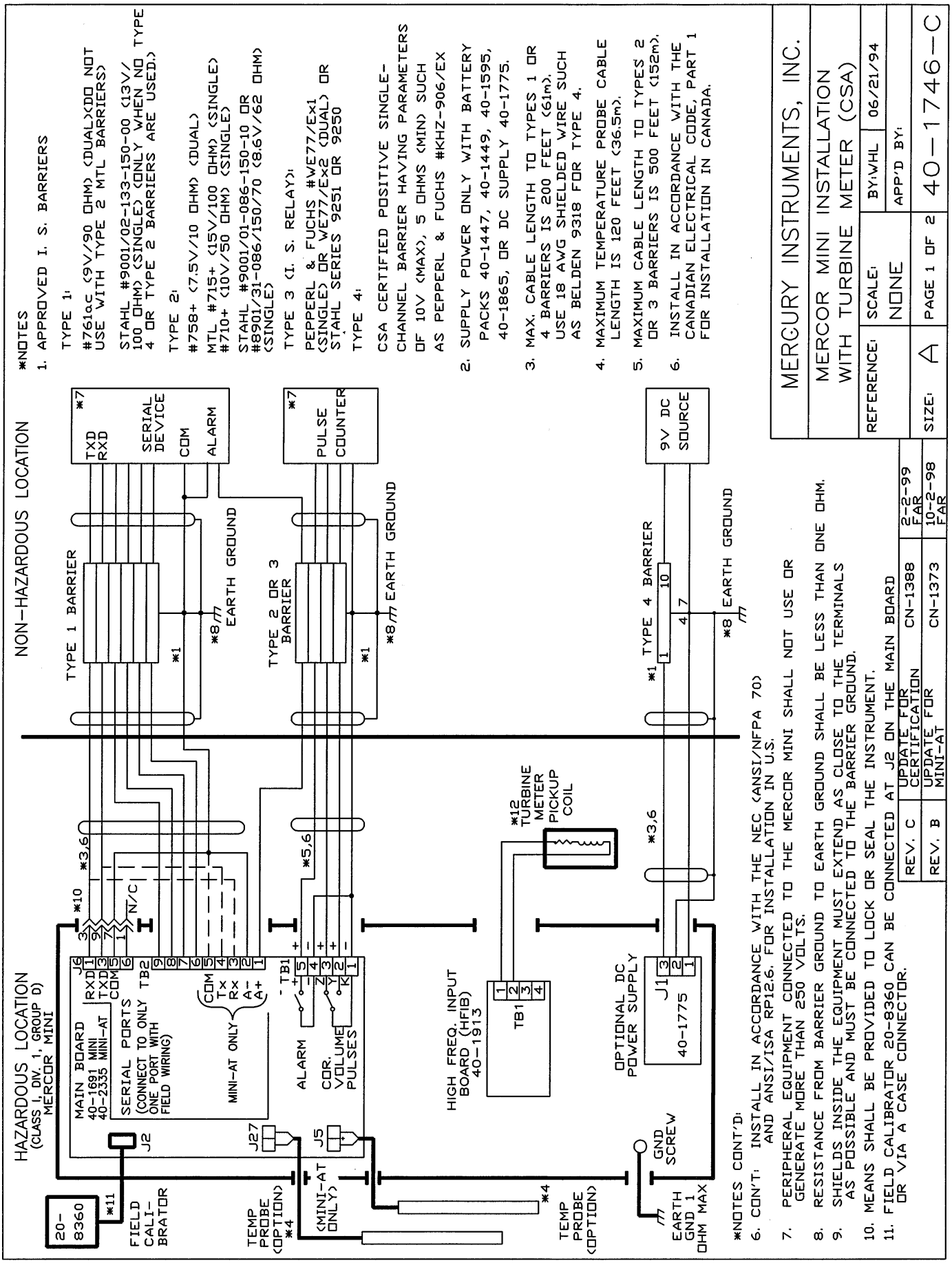
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUP D)
MERCOR MINI
NON-HAZARDOUS LOCATION
MAIN BOARD
40-1691 MINI
40-2335 MINI-AT
SERIAL PORTS
(CONNECT TO ONLY ONE PORT WITH FIELD WIRING)
MINI-AT ONLY
ALARM
COR, VOLUME PULSES
HIGH FREQ. INPUT BOARD (HFIB) 40-1913
OPTIONAL DC POWER SUPPLY
40-1775
TYPE 1 BARRIER
TYPE 2 OR 3 BARRIER
TYPE 4 BARRIER
SERIAL DEVICE
PULSE COUNTER
9V DC SOURCE
EARTH GROUND
TURBINE METER PICKUP COIL
FIELD CALI-BRATOR
20-8360
TEMP PROBE (OPTION)
GND SCREW
EARTH GND 1 OHM MAX
*NOTES
1. APPROVED I. S. BARRIERS
TYPE 1:
#761ac (9V/90 OHM) (DUAL)XDO NOT USE WITH TYPE 2 MTL BARRIERS)
STAHL #9001/02-133-150-00 (13V/100 OHM) (SINGLE) (ONLY WHEN NO TYPE 4 OR TYPE 2 BARRIERS ARE USED.)
TYPE 2:
#758+ (7.5V/10 OHM) (DUAL)
MTL #715+ (15V/100 OHM) (SINGLE)
#710+ (10V/50 OHM) (SINGLE)
STAHL #9001/01-086-150-10 OR #8901/31-086/150/70 (8.6V/62 OHM) (SINGLE)
TYPE 3 (I. S. RELAY):
PEPPERL & FUCHS #WE77/Ex1 (SINGLE) OR WE77/Ex2 (DUAL) OR STAHL SERIES 9251 OR 9250
TYPE 4:
CSA CERTIFIED POSITIVE SINGLE-CHANNEL BARRIER HAVING PARAMETERS OF 10V (MAX), 5 OHMS (MIN) SUCH AS PEPPERL & FUCHS #KHZ-906/EX
2. SUPPLY POWER ONLY WITH BATTERY PACKS 40-1447, 40-1449, 40-1595, 40-1865, OR DC SUPPLY 40-1775.
3. MAX. CABLE LENGTH TO TYPES 1 OR 4 BARRIERS IS 200 FEET (61m). USE 18 AWG SHIELDED WIRE SUCH AS BELDEN 9318 FOR TYPE 4.
4. MAXIMUM TEMPERATURE PROBE CABLE LENGTH IS 120 FEET (36.5m).
5. MAXIMUM CABLE LENGTH TO TYPES 2 OR 3 BARRIERS IS 500 FEET (152m).
6. INSTALL IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1 FOR INSTALLATION IN CANADA.
*NOTES CONT'D:
6. CON'T: INSTALL IN ACCORDANCE WITH THE NEC (ANSI/NFPA 70) AND ANSI/ISA RP12.6. FOR INSTALLATION IN U.S.
7. PERIPHERAL EQUIPMENT CONNECTED TO THE MERCOR MINI SHALL NOT USE OR GENERATE MORE THAN 250 VOLTS.
8. RESISTANCE FROM BARRIER GROUND TO EARTH GROUND SHALL BE LESS THAN ONE OHM.
9. SHIELDS INSIDE THE EQUIPMENT MUST EXTEND AS CLOSE TO THE TERMINALS AS POSSIBLE AND MUST BE CONNECTED TO THE BARRIER GROUND.
10. MEANS SHALL BE PROVIDED TO LOCK OR SEAL THE INSTRUMENT.
11. FIELD CALIBRATOR 20-8360 CAN BE CONNECTED AT J2 ON THE MAIN BOARD OR VIA A CASE CONNECTOR.
REV. C UPDATE FOR CERTIFICATION CN-1388 2-2-99 FAR
REV. B UPDATE FOR MINI-AT CN-1373 10-2-98 FAR
MERCURY INSTRUMENTS, INC.
MERCOR MINI INSTALLATION WITH TURBINE METER (CSA)
REFERENCE:
SCALE: NONE
BY: WHL 06/21/94
APP'D BY:
SIZE: A
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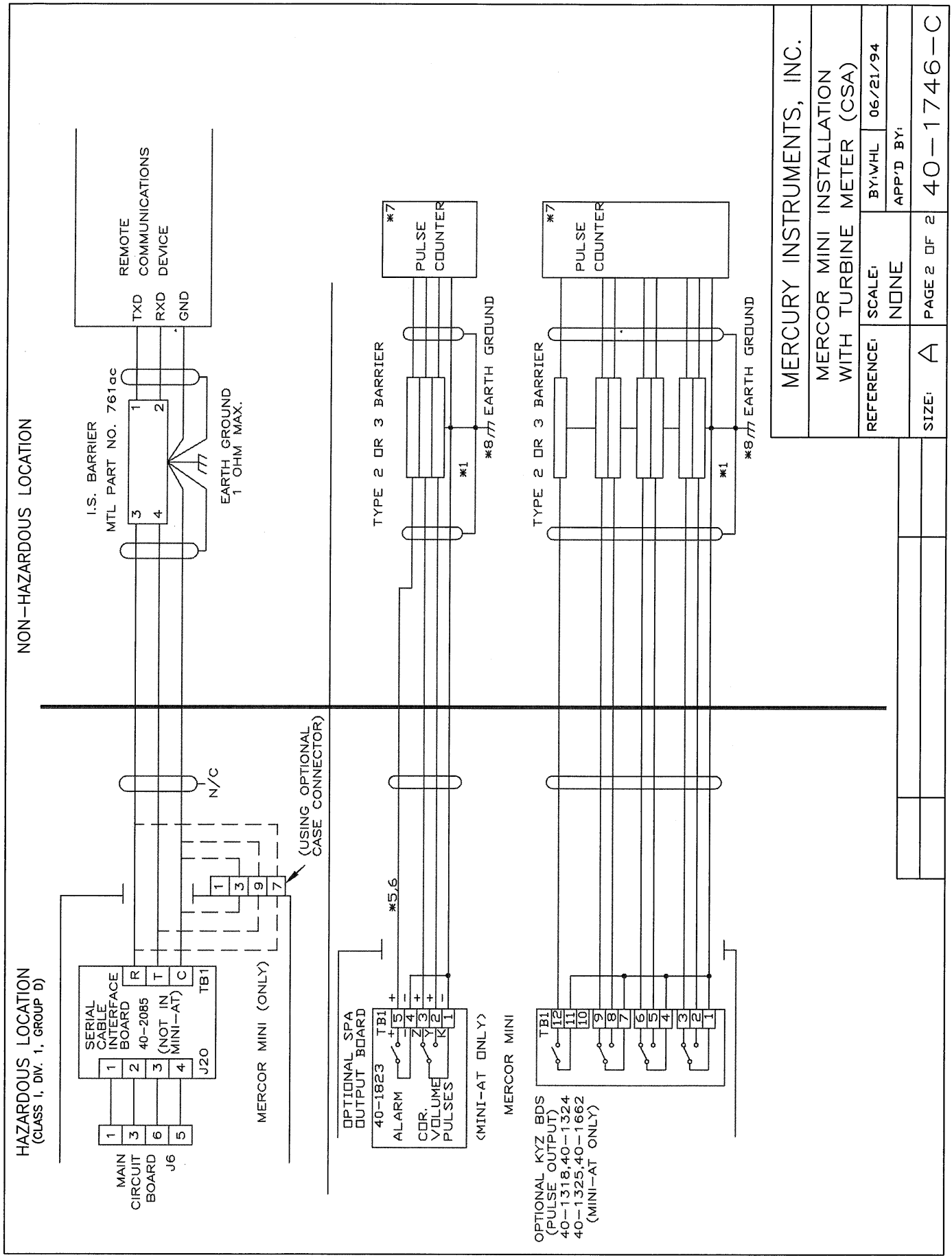
NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
(CLASS I, DIV. 1, GROUP D)
REMOTE COMMUNICATIONS DEVICE
TXD
RXD
GND
I.S. BARRIER
MTL PART NO. 761ac
EARTH GROUND
1 OHM MAX.
N/C
(USING OPTIONAL CASE CONNECTOR)
SERIAL CABLE INTERFACE BOARD
40-2085
(NOT IN MINI-AT)
TB1
J20
MAIN CIRCUIT BOARD
J6
MERCOR MINI (ONLY)
OPTIONAL SPA OUTPUT BOARD
40-1823
ALARM
COR. VOLUME PULSES
*5,6
(MINI-AT ONLY)
MERCOR MINI
TYPE 2 OR 3 BARRIER
*7
PULSE COUNTER
*1
*8
EARTH GROUND
OPTIONAL KYZ BDS
(PULSE OUTPUT)
40-1318,40-1324
40-1325,40-1662
(MINI-AT ONLY)
MERCURY INSTRUMENTS, INC.
MERCOR MINI INSTALLATION
WITH TURBINE METER (CSA)
REFERENCE:
SCALE: NONE
BY: WHL 06/21/94
APP'D BY:
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