Operation Manual

MiniLog (Model : ML1A and ML1A-FL)

Digital + BattV + TempC Data Logger

HYQUEST SOLUTIONS

QUALITY SYSTEM

ISO: 9001

CERTIFIED

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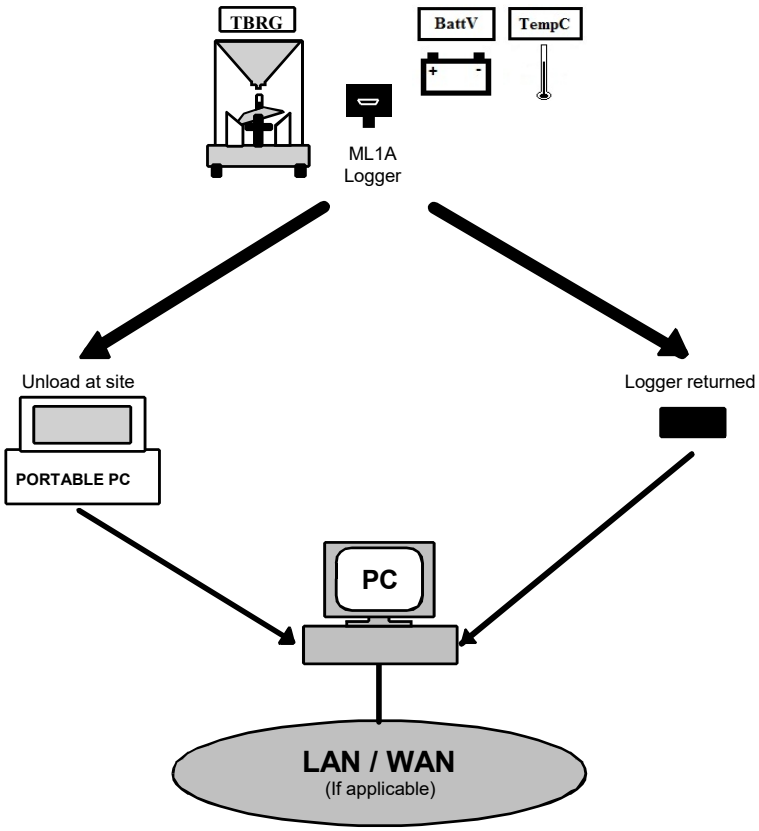
1. INTRODUCTION

The HyQuest Solutions MiniLog Data Logger ML1A and ML1A-FL have been designed using surface mount technology to provide a very small, ultra-low power and reliable data logger that can be used in harsh environments for extended periods. Flash memory technology has not only been used for data storage but also for program storage - which provides secure non-volatile data storage as well as the unique capability of software download as new software features and revisions become available. The logger can be connected to a standard Tipping Bucket Rain Gauge OR any device that requires a contact closure to be monitored – it also monitors an external 12V battery, the internal battery and the ambient temperature inside the MiniLog enclosure. The communication features allow for very flexible operation directly connected to a computer. The unique on-board help feature allows the user to obtain a list of commands with syntax. The ultra-low power allows the logger to be powered from an internal 3.6V AA lithium battery for about 1 year or a 1.5V AA alkaline battery for about 6 months. The indicator LED flashing once a second as a heartbeat, gives the user confidence that the MiniLog is alive and well.

The only difference between the ML1A and the ML1A-FL is the supplied ”Fly Lead” wired to the digital input !



2. PRODUCT OVERVIEW

2.1 Overview

The HyQuest Solutions MiniLog Data Logger is easily installed within many products due to its small size. Its primary purpose is to count contact closures.

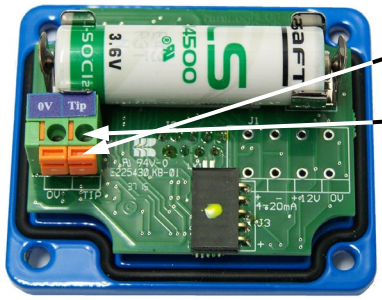
One such application would be inside a Tipping Bucket Rain Gauge, (TBRG). Rain falling on the collecting funnel is directed through a syphon control unit and discharges as a steady stream into a 2 compartment bucket mounted in unstable equilibrium. As each compartment fills, the bucket tilts alternately about its axis. Each tip forces a contact closure of a magnetic reed switch corresponding to a height of rainfall depending on bucket capacity, (Bucket Capacity can be 0.2 mm, 0.5 mm, 1.0 mm, 0.01 inch). The logger unit accepts the contact closure and records the event as a time stamp to one second resolution. Each event is stored in secure, non-volatile flash memory.

The data extraction process is accomplished via a PC or similar. A simple one-to-one DB9 cable connection is made between the PC and logger to allow data retrieval upon operator command. The data format of the logger file is specified within this document.

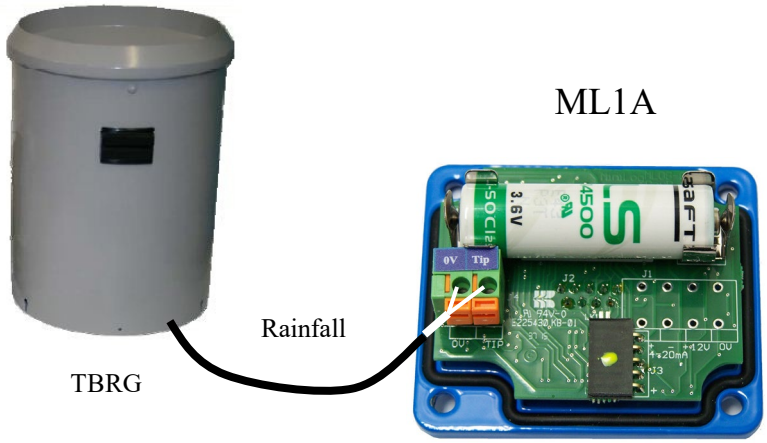
3. INSTALLATION

The MiniLog has a single DB9 female connector, which is mainly used for communications – (the digital input and external power may be taken through this connector, making it pin compatible with the ML1). The pinout is designed to be compatible with direct connection to a PC Comm port. Note that when external power is supplied, whether though an external 12V battery or RS232 handshake lines, the power drawn from the internal battery is reduced to zero.

The digital input from the TBRG is connected to the internal screw less terminal blocks – these specific terminals are used because they keep a constant tension on the wires that are inserted.



1. Use a small flat blade screwdriver and push-down on the orange lever.
2. Insert the stripped wire here.
3. Release the orange lever to secure the wire.
4. Pull on the wire to make sure it is secure.

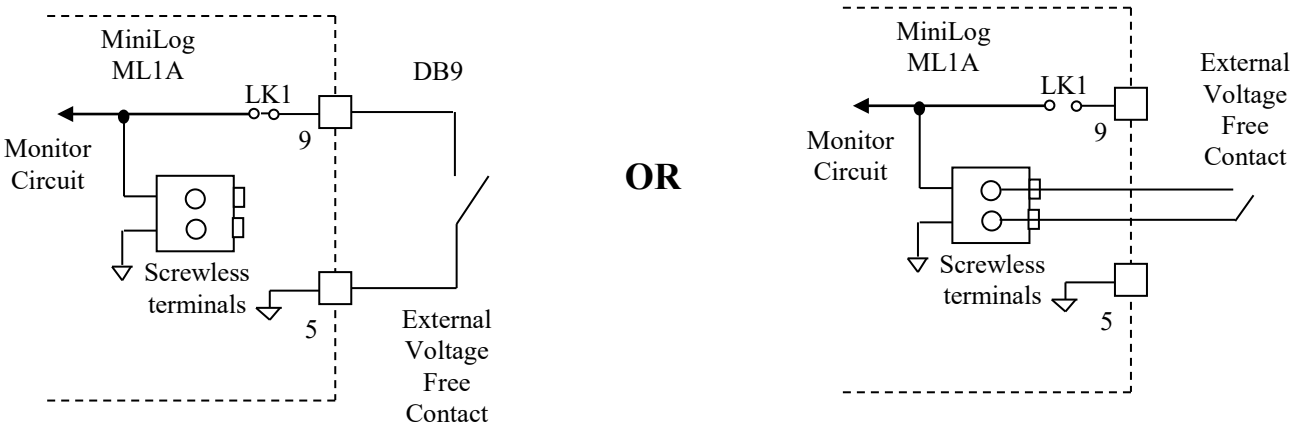


"ML1A Typical Application"

3.1 Hardware Connections

3.1.1 Contact Closure input

The voltage free contact to be monitored should be connected either between Pin 9 (contact closure input) and Pin 5 (Gnd) with PCB solder link LK1 bridged OR it can be connected to the internal screwless terminal block, through a cable gland on the enclosure. (**Note** that the PCB solder link LK1 is an option that is left open circuit when the ML1A is supplied from the factory.) (**Also Note:** In the first option (shown on the left), an extra tip will be generated when the DB9 connector is plugged into a PC, unless pin 9 is clipped on the DB9 lead.)



Connection of Contact Closure Input

3.1.2 External Power Supply

The ML1A draws power from the RS232 signals for communications – which relieves the internal battery from this power drain.

The ML1A may be powered externally through the DB9 connector if required – see section 3.1.3. for the connections required. The internal and external voltage is measured and logged periodically by the logger. The logging interval is set with the "BVINT" command, which can be set from 1 to 999 minutes. The logged data can be retrieved with the DUBVI (internal battV) command, DUBVE (external battV) command, DUBVT (battV and tempC) command or the DUALL (dump All) command.

While the MiniLog ML1A is in the field monitoring the contact closure, an external power supply is **not** required. The logger enters a "sleep" mode, waking only to update the time, and log a contact closure event. In this mode the logger will operate continuously for about 1 year on the internal 3.6V lithium battery (or 6 months on a 1.5V alkaline battery). In either case we recommend the battery be replaced annually to ensure the continuity of your data.

3.1.3 Communications

The pinout of the DB9 female connector on the front of the ML1A logger is as follows :-

Pin Connection	ML1A Logger Signal Name DB9 Female		PC Signal Direction	PC Signal DB9 Male
1	No Connection		⇒	CD
2	Tx (RS232 Serial data output)		⇒	Rx
3	Rx (RS232 Serial data input)		⇐	Tx
4	External Power (+ DTR / DSR loop)		⇐	DTR
5	Gnd			Gnd
6	External Power (+ DSR / DTR loop)		⇒	DSR
7	External Power (+ RTS / CTS loop)		⇐	RTS
8	External Power (+CTS / RTS loop)		⇒	CTS
9	Contact closure input (See note 3)		⇒	RI

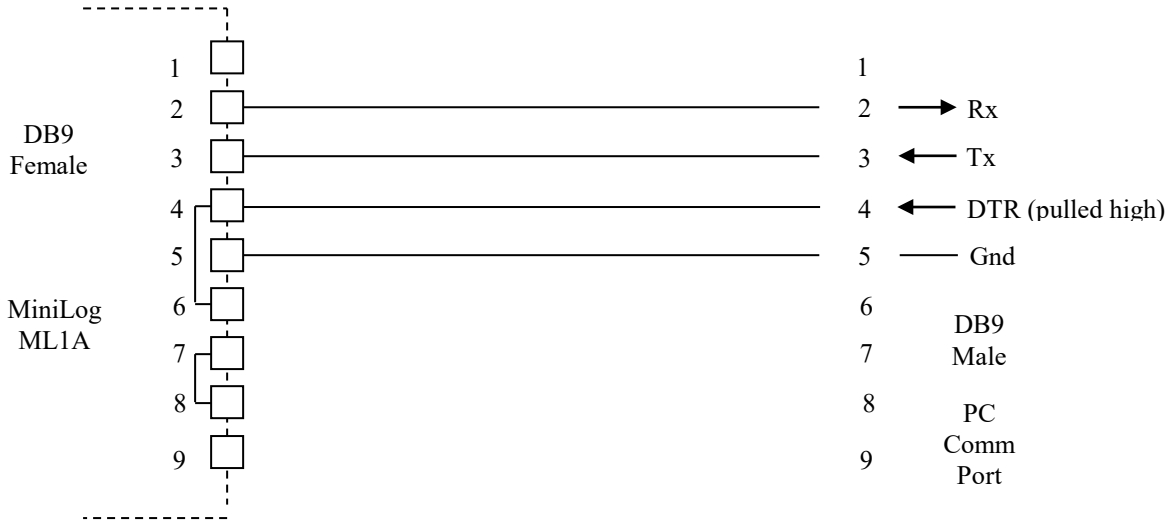
Notes:

1. When the ML1A is directly connected to a PC the following handshake signals are linked
   - Pins 4 and 6 are linked together inside the ML1A.
   - Pins 7 and 8 are linked together inside the ML1A.

2. When the ML1A is directly connected to a PC, sufficient power is extracted from the handshake signals to power the ML1A – which prevents power drain from the internal battery while communications is in progress.

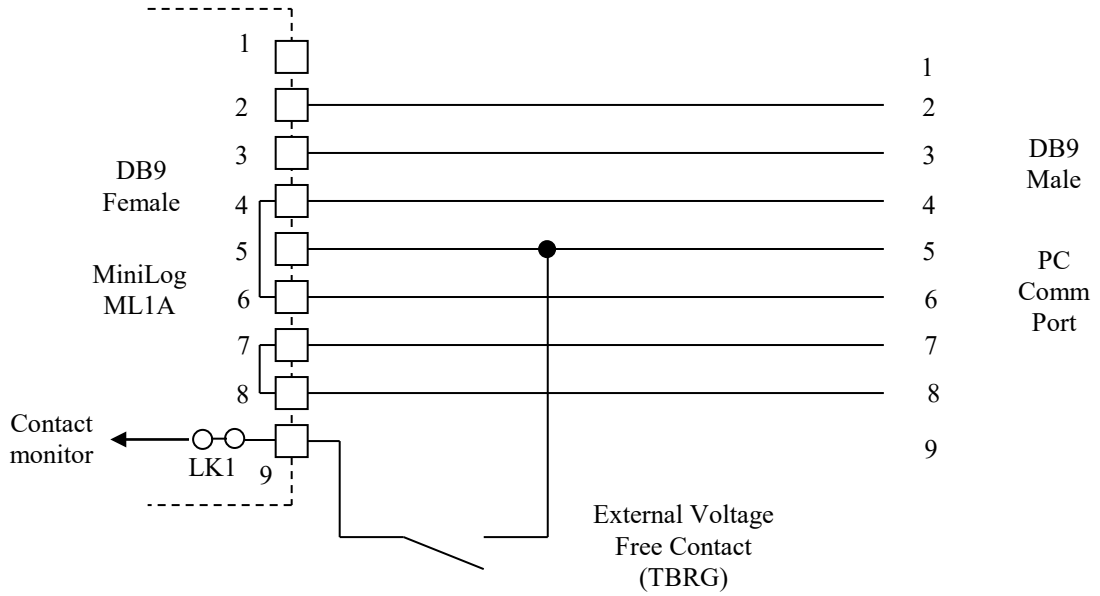
3. A solder link LK1 on the ML1A PCB allows the digital input from the TBRG to be connected through pin 9 of the DB9F connector. See section 3.1.1 for more details.

The DB9 female connector on the logger is the communications port and is setup as a DCE. This allows direct connection to a PC comm port using a DB9 male to DB9 female 1-to-1 cable. (The minimum connection is pins 2, 3, 4 and 5.)



Minimum Connection of PC on DB9F

Communications can also be active while the contact closure input on pin 9 is used when jumper LK1 is soldered, and a special cable is prepared.



Connection of PC together with Contact Closure Input through the DB9F

3.2 Setup and Configuring the Logger

Once the ML1A logger has been connected to a computer, the parameters can be setup using WinComLog or any 'dumb' terminal emulation program. (NOTE: If a third party application is used, the handshake signals DTR and RTS should be forced high to enable the MinLog to have power.) If using a third party program, it should be set for the appropriate baud rate, and 8/N/1 (bits/parity/stop), handshake off, and "local echo on". On receipt of individual commands from the computer, the logger will respond with the present parameter setting. (Note that the command keywords permit both upper and lower case characters, or a combination of both.) A carriage return (< CR > , Enter Key) immediately following an entry will action the command. Invalid entries return a "Command Error" response. A list of all logger commands may be viewed on the computer screen by using the unique on-board help system. Simply type ? and then press the Enter key.

Data and parameter security is provided by means of a user password. Any data or parameters may be viewed without a password, but parameters may only be altered and data may only be cleared after the password has been entered correctly. The default password when the logger is supplied is "BOMM". Parameters may be entered by typing the command, then the equals symbol (=) and then the new parameter, followed by the Enter key.

3.2.1 Site Information

The "Site Information" (SI) is a user definable 16 character string that allows each logger to have a unique location name. Alternatively, loggers in a locality may be given the same name and the rainfall channel ID may be used to uniquely identify the logger data. This allows for easy identification of dumped data or status window information. See section 4.1.8 for more information on this command.

3.2.2 System Time/Date

The "Time" (T) and "Date" (D) should be checked for accuracy during installation.

The "Time Adjust" (TA) command allows the Real Time Clock to be adjusted for crystal frequency inaccuracies.

3.2.3 Sensor + Parameters

The Minilog ML1A has several parameters that allow characterisation of the sensor being used. The "Channel ID" (CHID) is a 7 digit user definable number that should be set to uniquely identify the digital (rainfall) channel. The "Increment" (INC) parameter defines the capacity of the specific digital sensor used as well as the number of external events that constitute one logged event - this determines the digital input resolution.

See section 4.1.4 for more information on these commands.

3.2.4 Communications

The MiniLog ML1A has an RS232 serial interface to support asynchronous ASCII communications to accommodate data extraction and user set-up. This port operates at 1200, 2400, 4800, 9600, 19200, 38400 and 57600 baud with 8 data bits, no parity and 1 stop bit.

If initially you can't establish communications with the ML1A, try each of the 7 baud rates, in case it has been changed from the default rate of 9600.

Each digital input event that is logged is also transmitted on the serial port, unless the event output flag is off (EV=off).

3.2.5 First Time Installation Summary

***** Make sure a fresh battery is installed *****

```
                // Connect the TBRG Raingauge to the logger input
                // Connect your PC and start WinComLog

passwd=BOMM             // Enter the password
si=MySiteName           // Enter your site name
d=23/10/17              // Set the date
t=10:35:30              // Set the time
inc=0.5/01              // Make sure the bucket increment matches your TBRG (0.5mm)
                // Tip the bucket a few times

dur                     // make sure the data is logging
clr                     // Clear any previous data

                // Unplug your PC
                // Congratulations, your done – the logger will now record all TBRG tips.
```

4. OPERATION

4.1 Commands / Syntax

The following sections give detailed information on each of the MiniLog ML1A commands. Simply type the command and then press enter to view the parameter. To change a parameter, the password must first be entered, and then type the command followed by =, then the new parameter followed by Enter. Eg. SI=Sydney then press Enter.

4.1.1 On-line Help (?)

Type a **?** then press Enter to get the following help screen. The commands are listed in alphabetical order.

On-line Help

```
?
ML1A Data Logger Command Syntax              [...] = optional to set parameter

(Command may be upper and/or lower case)     <CR>  = press carriage return
======== General Commands ========================================================
BAUD[=xxxx]<CR>    (comms BAUD rate)         BYE<CR>              (exit passwd access)
CLEARx[=30char]<CR>  (Clear Seq.x=1,2,3,4)   D[=d/m/y OR m/d/y]<CR> (Date)
EV[=On/Off]<CR>    (EVent output)            FMT[=dmy/mdy]<CR> (date ForMaT)
ID<CR>             (logger ID)               LOG[=On/Off]         (En/Disable Logging)
MW[=On/Off]<CR>    (Memory Wrap)             PASSWD=****<CR>   (4 char password)
RE[=On/Off]<CR>    (REsponse output)         RESET<CR>            (software RESET)
SI[=16chars]<CR>   (SIte name)               SLEEP[=N]<CR>        (Set Sleep time mins)
ST<CR>             (STatus window)           T[=hh:mm:ss]<CR>     (Time)
TA[=hh:mm:ss]      (Time Adjust)             VER<CR>              (s/w VERsion)
======== Battery Voltage and Temperature Commands ================================
BV<CR>             (Batt. Voltages now)      BVINT[=mmm]          (BV/TempC log INTerval)
TEMPC<CR>          (TEMPerature oC now)
======== Digital Input Commands ==================================================
CHID[=7 dig]<CR>   (CHannel ID - Digital)    INC[=x.x/mm]<CR>     (INCrement+mult.)
TDAY<CR>           (Total toDAY)             TOT<CR>              (TOTal)
TYPED[=16chars]<CR>  (TYPE of Dig i/p)       UD[=8char]<CR>       (Units Digital)
======== Dump/Clear Commands ====================================================
DUR/N/h:m/d/m/y<CR>  (DUmp Rain log)         CLR<CR>              (Clear all Records)
DUBVI[....]<CR>    (DUmp BattV.Internal)     DUBVE[....]<CR>      (DUmp BattV.External)
DUTMP[....]<CR>    (DUmp TempC)              DUBVT[....]<CR>      (DUmp BattV+TempC)
DUALL[....]<CR>    (DUmp ALL Data)           (All dump commands have the same syntax)
eg. DUR                    => Dump all Rainfall data
    DUR/3                  => Dump last 3 days of Rainfall data
    DUR/10/12:00/15/2/16   => Dump 10 days of Rainfall data from 12:00 15-Feb-16
--------------------------------------------------------------------------------------------------------------------
```

4.1.2 Communications (BAUD, EV, RE, CLEAR)

The "Baud" (**BAUD**) command allows the baud rate to be viewed or changed. Acceptable baud rates are 1200, 2400, 4800, 9600, 19200, 38400 and 57600.

BAUD<CR>	Display the present baud rate
BAUD= 9600<CR>	Set the baud rate to 9600 baud

The "Event" (**EV**) flag allows the time stamps that are transmitted on the serial port to be enabled or disabled. When an event occurs, the time is transmitted on the serial when EV is on. When EV is off, nothing is transmitted on the serial port when an event occurs.

EV<CR>	Display the state of the event flag.
EV=ON<CR>	Enable event reporting
EV=OFF<CR>	Disable event reporting

The "Response" (**RE**) flag allows the error response to commands, to be enabled or disabled. When RE is on then you may see "Command Error" or "Syntax Error" messages appear if the MiniLog does not understand what was typed. When RE is off then there will be no response if the MiniLog does not understand what was typed.

RE<CR>	Display the state of the response flag.
RE=ON<CR>	Enable all error responses.
RE=OFF<CR>	Disable all error responses.

The "Clear" (**CLEAR1/2/3/4**) command sequences are used to control an external modem – that is, force it into a known state. (Due to the worldwide removal of wireless dialup PSTN modem access, these sequences should be left clear. Eg. Set CLEAR1=<CR> then CLEAR2=<CR> then CLEAR3=<CR> and finally CLEAR4=<CR>)

The Clear sequences are performed when a Bye command is received, and/or if no comms is received within the Sleep timer period.

There is a maximum of 30 characters in each of the 4 clear sequences. Special characters include ~ = 0.5 second pause and ^ = CTL character (Eg ^M = carriage return)
The format of each sequence is CLEAR1 = Command Sent / Expected Reply / Timeout
Eg **CLEAR1=+++~~ATH^M/OK/10** Sends +++, then waits 1 second, then send ATH<CR> then waits up to 10 seconds for an OK response.

The expected reply and the timeout parameters are optional. If no timeout is specified, then a default of 60 seconds is used. The timeout may be a one or two digit number.

CLEAR1<CR>	Display the clear1 sequence
CLEAR1=+++~~<CR>	Set the clear 1 sequence. Send +++ then wait 1 sec
CLEAR1=+++//5<CR>	Send +++, no response and wait 5 seconds

After CLEAR1 sequence is performed, CLEAR2 then CLEAR3 and finally CLEAR4 sequence is performed.

4.1.3 Battery Voltage (BV, BVINT)

The MiniLog battery voltage is measured and displayed when the battery voltage command (**BV**) is executed as well as during a status window command (**ST**)

BV<CR>	Displays the internal and external battery voltages

The battery voltage log interval can be set with the (**BVINT**) command from 1 to 999 mins. The internal battery, external battery and temperature are logged at this interval. The logged data can be retrieved using the DUBVI, DUBVE, DUBVT and DUALL commands.

BVINT<CR>	Displays the log interval in mins.
BVINT=015<CR>	Set the battery and temperature log interval to 15 mins.

4.1.4 Temperature (TEMPC)

The MiniLog temperature is measured and displayed when the temperature command (**TEMPC**) is executed as well as during a status window command (**ST**)

TEMPC<CR>	Displays the internal temperature in degrees C

The temperature log interval is set with the (**BVINT**) command above, from 1 to 999 mins. The internal battery, external battery and temperature are logged at this interval. The logged temperature can be retrieved using the DUTMP, DUBVT and DUALL commands.

4.1.5 Digital Channel Parameters (CHID, INC, TDAY, TOT, TYPED, UD)

The "Channel ID" (**CHID**) is a 7 digit user definable number that should be set to uniquely set to identify the channel.

CHID<CR>	Displays the present Digital Channel ID
CHID=0012345<CR>	Sets the Digital Channel ID to 0012345

The "Increment" (**INC**) is a parameter that specifies the quantity that each contact closure represents. This might be 0.2mm of rain for a tipping bucket rain gauge, or 10 litres of water for a flow meter, or 1 widget for a product counter. The parameter is split into 2 parts – the first part is the amount that each contact closure represents, and the second part is the number of contact closures that represent one event. The increment command has 5 different acceptable formats.

INC<CR>	Display the existing increment parameter.
INC=0.01/01<CR>	Defines say a TBRG bucket of 0.01 inches of water, and one tip represents one logged event.
INC=0.2/01<CR>	Defines say a TBRG bucket of 0.2 mm of water, and one tip represents one logged event.
INC=10/10<CR>	Defines say 10 litres of water per contact closure of a flow meter, and 10 such closures logged as one event. This means that each event represents100 litres of water.
INC=100/01<CR>	Defines say 100 litres of water per contact closure of a flow meter, and 1 such closure logged as one event.
INC=1000/05<CR>	Defines say 1000 washers in a box, and 5 such boxes logged as one event. This means that each event represents 5000 washers.

The "Total" (**TOT**) command allows the Total number, of whatever is being counted, to be displayed. This is the total since the last reset – or the total since the last CLR record clear.

TOT<CR>	Displays the total of what is being counted since the last record clear.

The "Total Today" (**TDAY**) command allows the Total number, of whatever is being counted, to be displayed. This is the total today since midnight.

TDAY<CR>	Displays the total of what is being counted since midnight.

The "Type Digital" (**TYPED**) is a 16 character user defined string that allows the Status Window to be customised for your counting application. It simply changes the aesthetics of the Status Window. The MiniLog may be used for accumulating Rainfall, measuring Flow, counting People or Cars etc…. It is best to start this parameter with a capital letter – for aesthetic reasons.

TYPED<CR>	Display the digital channel Type
TYPED=Rainfall<CR>	Set the digital type to Rainfall
TYPED=Flow<CR>	Set the digital type to Flow.

The "Units Digital" (**UD**) is a user defined 8 character string that assists in defining what is being counted. For example it may be mm or inches or litre/hr or widgets. This parameter is so the retrieved data has meaning.

UD<CR>	Display the present units.
UD=mm<CR>	Set the units to mm.

4.1.7 Date/Time Parameters (D, FMT, T, TA)

The MiniLog date and time is maintained by the microprocessor, and the LED flashing once a second indicates that the logger is alive and operational. (This flash is only 1mS in duration and consequently the power consumption is negligible.)

The "Date" (**D**) is displayed as day/month/year or month/day/year with slash separators. (This depends upon the format (**FMT**) parameter.)

D<CR>	Displays the date.
D=22/09/05<CR>	Set the date. (Note: leading zeros are optional, BUT
D=9/3/5<CR>	day+month+year must be entered)

The "Format"(**FMT**) parameter is used to change the date format to either day/month/year or month/day/year.

FMT<CR>	Display the present format as "dmy" or "mdy"
FMT=dmy<CR>	Set the date format to day/month/year.
FMT=mdy<CR>	Set the date format to month/day/year

The "Time" (**T**) is displayed in 24 hour format separated by colons. When entering the time and date, all fields must be entered. Note that if the time is entered as T= then it will be reset to midnight 00:00:00.

T<CR>	Displays the time in 24 hour format
T=9:45:00<CR>	Set the time (Note: leading zeros are optional BUT
T=16:7:0<CR>	hrs+mins+secs must be entered)

The "Time Adjust" (**TA**) command performs the same function as the time (T) command, except it determines if the clock is running fast or slow, and calculates an adjustment to add or subtract 1 second every xxx hours. In effect, this is a software adjustment to bring the clock into specification. A sample procedure would be :

1. Set the time accurately using the T=12:35:00<CR> command
2. Wait at least 12 hours (the longer the time period the better the accuracy – this could be over many months.)
3. Set the time again using the TA=17:13:30<CR> command

The new time adjustment will be calculated and displayed. (NOTE: If there is already a time adjustment in progress, then the MiniLog will take this into account when calculating the new adjustment.) After this procedure the clock accuracy will be improved considerably.

TA<CR>	Display the present time adjustment eg. +1 Sec every 0014 hours
TA=<CR>	Remove the existing time adjustment.
TA=10:13:55<CR>	Set the time to 10:13:55 and calculate the new time adjustment.

4.1.8 Dump Log Records (DUR, ….DUALL, CLR, MW, LOG)

(DUR, DUBVI, DUBVE, DUBVT, DUTMP, DUALL, CLR, MW, LOG)

The MiniLog ML1A logged data is stored in the on-board flash memory.

The "Dump Rain log" (**DUR**) command, unloads the historical records from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear rain log user command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! When the memory becomes full, with Memory Wrap off, the logger stops logging and tacks a "Mem Full" message onto the end of an event message. When Memory Wrap is on, and memory becomes full, the oldest records are erased and replaced by the newest records. The log is dumped in ascii format, as shown in section 4.2.1.

DUR<CR>	Dump the complete rain log record.

The "DUR" command also allows for searching through the log and starting at a specific location instead of always dumping the complete log record.
Syntax : DUR / No of days / Time / Date

Examples :

DUR/2<CR>	Dump 2 full days of data, starting 2 days back from the current date at 00:00
DUR/1/1:40<CR>	Dump 1 day of data starting at 1:40am today
DUR/30/12:00/1/1/11	Dump 30 days of data starting at 12:00pm on 1-Jan-2011
DUR/12/15:30/13	Dump 12 days of data starting at 3:30pm on the 13th day of the current month and year. (Note that the date format in this example is Day/Month/Year)
DUR/L	Dump all the data since the last dump

NOTE : The format of the date in the DUR command depends upon the date format in the MiniLog – that is either Day/Month/Year or Month/Day/Year.

The "Dump Internal Battery Voltage log" (**DUBVI**) command, unloads the internal battery voltage log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVI<CR>	Dump the complete internal battery voltage log record.

(The DUBVI command has all the same search syntax as the DUR command.)

The "Dump External Battery Voltage log" (**DUBVE**) command, unloads the external battery voltage log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVE<CR>	Dump the complete external battery voltage log record.

(The DUBVE command has all the same search syntax as the DUR command.)

The "Dump Battery Voltages and Temperature log" (**DUBVT**) command, unloads the internal and external battery voltage and temperature log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVT<CR> Dump the complete internal+external BV + tempC log record.

(The DUBVT command has all the same search syntax as the DUR command.)

The "Dump Temperature log" (**DUTMP**) command, unloads the temperature log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUTMP<CR> Dump the complete temperature log record.

The DUTMP command has all the same search syntax as the DUR command.

The "Dump All log" (**DUALL**) command, unloads all data from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUALL<CR> Dump the complete log of all parameters.

The DUALL command has all the same search syntax as the DUR command.

The "Memory Wrap" (**MW**) command, enables or disables the wrapping of memory. When memory wrap is on, and the historical log becomes full, then the first data stored will be erased one block at a time. (A block of Flash memory holds approximately 400 events, and there are 1023 blocks available.) In this mode memory never becomes full, and the most recent data is always available. It is advisable that when changing the state of the Memory Wrap flag, the existing logged data be erased so that logging can start afresh.

MW<CR> Display the present state of the memory wrap flag
MW=ON<CR> Turn memory wrap on.
MW=OFF<CR> Turn memory wrap off.

NOTE: It is best to clear all of memory (using CLR) when changing this flag.

The "Clear Record" (**CLR**) command erases the complete memory log of all history – **note** that this command erases the Rain, Battery Voltage and Temperature logs. A question will appear to remind the user that all data will be erased – answer y or Y to delete the log and any other key to abort.

CLR<CR> Erase complete log record.
*** This will clear the Rain, Battery and TempC Logs *** : Are you sure ? (Y/N) Y

The "Log" (**LOG**) command allows logging to memory, to be turned on or off. This is used to test a logger without disturbing the existing logged data. The LED will still flash and the event will appear on the comms (if EV is on) so the operator can verify the event has been recognised. When the comms cable is removed (or the sleep timer expires), logging is automatically turned on !

LOG<CR>	Display the present state of the Log parameter
LOG=OFF<CR>	Turn logging off (Events are not logged to memory)
LOG=ON<CR>	Turn logging on (Events are logged to memory again)

4.1.9 Miscellaneous (ID, SI, PASSWD, BYE, SLEEP, RESET, VER)

The "Logger Identification" (**ID**) is a unique number embedded in the MiniLog at the time of manufacture and can only be read. (The first 2 numbers are the year of manufacture)

ID<CR>	View the logger ID. Eg. MJ110001

The "Site Name" (**SI**) variable is used to either identify a specific logger or the location of the logger. This is a variable string up to 16 characters long and can be any alphanumeric character. The user can use this field for whatever they wish.

SI<CR>	Display the present site name.
SI=Sydney<CR>	Set the site name to "Sydney"

The password (**PASSWD**) prevents unauthorised access to altering the parameters or clearing the historical log record. Password access is cleared when the comms is unplugged and the MiniLog returns to its sleep mode, or the BYE command is performed.

The password is a 4 character alphanumeric string that is upper / lower case sensitive. New passwords may be entered by first gaining access by entering the existing password, and then immediately entering the password command again with a new password.

PASSWD=BOMM<CR>	To attempt access, or change password if access already accepted.

If the password is set to the special value of ****, then the password function is disabled! That is, the user does not have to enter the password before they change parameters or clear memory. For example :

PASSWD=BOMM<CR>	Enable access.
PASSWD=****<CR>	Password function disabled.

This may be reversed by first entering the **** password and then entering a new password. For example :

PASSWD=****<CR> Enable access.
PASSWD=BOMM<CR> Save BOMM as the new password.

If the MiniLog is connected to a modem, then it may have the comms cable permanently connected. In this situation, once the password is entered, access is permanently granted. The "Bye" (**BYE**) command forces the MiniLog to cancel the password access, and also performs the CLEAR1/2/3/4 sequence of commands. (When the sleep timer expires, password access is also cancelled.)

The "Sleep" (**SLEEP**) command provides a timer, so that a "Bye" is performed if there is no communications in the preset time. The timer is set in minutes. For example, if "sleep" is set to 5 minutes, and there is no communications for a 5 minute period, then password access will be cancelled, and the CLEAR1/2/3/4 will be performed. When Sleep is set to 0, the function is disabled.

SLEEP = 5<CR> Sets the sleep timer to 5 minutes (Acceptable values are 0 to 9)

The "Reset" (**RESET**) command performs a hardware reset, but does not affect the time, date, parameters or logged data.

RESET<CR> Perform a reset of the MiniLog. Note that this command is equivalent to switching the logger off and then on again.

The "Version"(**VER**) command allows the MiniLog firmware version to be displayed.

VER<CR> Displays the MiniLog firmware version and date.

4.1.10 Status Window (ST)

The Status Window (ST) returns a summary of station set-up details together with a report of the present conditions. Each set-up parameter is identified by name followed by its unique command keyword, (parameter abbreviation). The Status window provides a 'plain English' response for visual interpretation when the ST command is issued.

Command Example

```
ST
Site(SI):                    Sydney          Rainfall Channel ID (CHID):    0012345
LoggerID(ID):                MJ110001        Rainfall Log Start:            22/01/16
Date(D):                     28/03/16        Rainfall Inc. (INC):           0.2/01
Time(T):                     10:06:46        Rainfall Today (TDAY):         5.2
Baud Rate (BAUD):            9600            Rainfall Total (TOT):          1260.8
Response On/Off(RE):         On              Rainfall Units (UD):           mm
Event Output (EV):           On
Events Left:                 321763          Temperature (TEMPC):           24.3C
Memory Wrap (MW):            Off             BV+T Log Interval(BVInt)mmm:   720
Go to sleep after (SLEEP):   5 min           Battery Volt (BV):             3.60/12.6V
Logging On/Off (LOG):        On
S/W Revision (VER):          5.01

Clear1:                      +++~~
Clear2:                      ATH^M/OK/9
Clear3:
Clear4:
-------------------------------------------------------------------------------------------------------------------
```

NOTE : The word "**Rainfall"** in the above Status Window, is the result of the TYPE parameter. This string can be changed to customise the Status Window to your requirements.

Note that the data in the Status Window is grouped to describe each area of the MLA, that is "general configuration" on the left, "digital input configuration" on the top right, and "battery / temperature configuration" at the lower right.

4.2 Data Output Format

4.2.1 Dump Log Record

The following data represents the historical log record as output from a MiniLog ML1A data logger. The example below represents a data record as presented to a computer after invoking a Dump Log Record command (DUR). Each parameter is separated by a 'space' character with each line terminating with a carriage return line feed marker, (< crlf >). Additional housekeeping events, identified as 'plain English' text fields, are automatically logged to the record on the instance of a variety of events. The text fields Record Clear, Time Change, Date Change and Record End are examples of some of the text event indicators.

The contact closure (or bucket tip from a rain gauge) is represented by a time stamp only. Look back through the log to obtain the date of the event. Other dump commands are shown on the following pages.

** Rainfall Record ** **DUR**

Station Set-up Header	**Sydney 0012345 MJ110001 0.2< crlf >**
Logger Start Header	**09:35:23 24/3/11 0 Record Clear< crlf >**
	10:25:37< crlf >
Events (time stamp)	**10:27:42< crlf >**
	16:53:05< crlf >
Daily Summary	**00:00:00 25/3/11 3< crlf >**
	15:43:09< crlf >
	15:44:23< crlf >
	15:45:00< crlf >
	22:22:55< crlf >
	00:00:00 26/3/11 4< crlf >
	22:24:00< crlf >
	00:00:00 27/3/11 0< crlf >
End of Record Marker	**Record End< crlf >**

Field	Par.	Parameter Definition
Station Set-up Header	Sydney	Site Name, variable length (16 char), user programmable.
	0012345	Channel ID Number or observational site number, 7 digits, user programmable.
	MJ110001	Logger ID, 6 digits, hard coded by manufacturer, where first two digits "MJ" represent an alphanumeric manufacturer ID followed by a six digit unit number.
	0.2	Recording Increment, 0.2 millimetres, user programmable.
Logger Start Header	09:35:23	Logger Start Time, Hour:Minute:Second.
	24/3/11	Logger Start Date, Day/Month/Year.
	0	Start Count, event accumulator, 0 counts.
	Record Clear	Indicator to identify start event, normally "Record Clear".
Event	10:27:42	Time Stamp of contact closure, Hour:Minute:Second.

Daily Summary	00:00:00 25/3/11 3	Time Stamp check at zero hours, Hour:Minute:Second. Date Stamp check at zero hours, Day/Month/Year. Daily event accumulator, (daily total = 3 events).
End of Record Marker	Record End	Indicator to identify the end of the log record.

** Internal Battery Voltage Record ** **DUBVI**

Station Set-up Header	**Sydney MJ110001< crlf >**
Logger Start Header	**09:35:23 24/3/11 Record Clear< crlf >**
	10:00:00 3.55< crlf >
Events	**11:00:00 3.55< crlf >**
(time + internal BattV)	**12:00:00 3.55< crlf >**
	23:00:00 3.54< crlf >
Midnight Marker	**00:00:00 25/3/11 < crlf >**
	00:00:00 3.54 <crlf>
End of Record Marker	**Record End< crlf >**

** External Battery Voltage Record ** **DUBVE**

Station Set-up Header	**Sydney MJ110001 < crlf >**
Logger Start Header	**09:35:23 24/3/11 Record Clear< crlf >**
	10:00:00 12.13< crlf >
Events	**11:00:00 12.12< crlf >**
(time + external BattV)	**12:00:00 12.12< crlf >**
	23:00:00 12.11< crlf >
Midnight Marker	**00:00:00 25/3/11 < crlf >**
	00:00:00 12.10 <crlf>
End of Record Marker	**Record End< crlf >**

** Battery Voltage + Temperature Record ** **DUBVT**

Station Set-up Header	**Sydney MJ110001 < crlf >**
Logger Start Header	**09:35:23 24/3/11 Record Clear< crlf >**
	10:00:00 3.55 12.13 25.1< crlf >
Events	**11:00:00 3.55 12.12 24.7< crlf >**
(time + internal BattV +	**12:00:00 3.55 12.12 24.4< crlf >**
external BattV + TempC)	**23:00:00 3.54 12.11 24.2< crlf >**
Midnight Marker	**00:00:00 25/3/11 < crlf >**
	00:00:00 3.54 12.10 23.1<crlf>
End of Record Marker	**Record End< crlf >**

** Temperature Record ** **DUTMP**

Station Set-up Header	**Sydney MJ110001 < crlf >**	
Logger Start Header	**09:35:23 24/3/11 Record Clear< crlf >**	
	10:00:00 25.1< crlf >	
Event	**11:00:00 24.7< crlf >**	
(time + TempC)	**12:00:00 24.4< crlf >**	
	23:00:00 24.2< crlf >	
Midnight Marker	**00:00:00 25/3/11 < crlf >**	
	00:00:00 23.1 <crlf>	
End of Record Marker	**Record End< crlf >**	

** Dump All Records ** **DUALL**

Station Set-up Header	**Sydney MJ110001 < crlf >**	
Events	**1, 24/03/11, 09:35:23, 0.2< crlf >**	**(=0.2mm rain)**
(type, date, time, level)	**3, 24/03/11, 10:00:00, 3.55< crlf >**	**(=3.55V BVint)**
	4, 24/03/11, 10:00:00, 12.13< crlf >	**(=12.13VBVext)**
	5, 24/03/11, 10:00:00, 25.1< crlf >	**(=25.1C Temp)**
	1, 24/03/11, 10:37:52, 0.2< crlf >	**(=0.2mm rain)**
	1, 24/03/11, 10:39:43, 0.2< crlf >	**(=0.2mm rain)**
End of Record Marker	**Record End< crlf >**	

The event types are :
0 = Housekeeping
1 = Rainfall / Digital input
3 = Internal Battery Voltage
4 = External Battery Voltage
5 = Temperature

5. SPECIFICATION

5.1 Hardware Specification

Microprocessor	Microchip PIC18F2680 nanowatt processor
Program Memory	Internal to microprocessor (64K bytes)
Program Upgrade	Via RS232 WinComLog Application
Data Memory	SST25VF032 or SST26VF032 32Mbit (=4MB) Serial Flash EPROM
Parameter Memory	EEPROM internal to microprocessor (1024 bytes)
Events Recorded	400,000 events, 1 second resolution
Real Time Clock	Day/Month/Year Hour/Minute/Second (32768 Hz crystal) Accuracy adjustable under software control
Inputs	1 x Digital input (for rain or flow etc..) (Maximum recording rate = 30 events per second) 1 x external Battery Voltage measurement (10 bit A-D sample) (+ Internal AA battery and temperature measurement)
Indicators	LED indicator
Connections	1 x DB9 Female + screwless spring clamp terminals
Communications	RS232 Port (Tx, Rx)
Power Supply	1 x Internal 3.6V Lithium AA cell (approx. 1 year operation) OR 1 x Internal 1.5V Alkaline AA cell (approx. 6 months operation) (All RS232 inputs diode-ored together with 12V supply)
Dimensions	70mm x 60mm x 40mm (W x H x D) (excludes gland) 70mm x 80mm x 40mm (W x H x D) (includes gland)
Weight	200 grams
Environmental	-40C to + 70C at 95% RH Non Condensing Aluminium waterproof housing IP67

5.2 LED Indicator

The LED indicator on the MiniLog ML1A will flash once a second. This heartbeat indicates that the MiniLog is alive and well. (Note that the flash is only 1 mS in duration and has an insignificant contribution to the battery life.)

When an external event or communication occurs, the LED flashes much longer. This makes it easy to distinguish an event from the heartbeat.

5.3 External Contact Interface

The MiniLog ML1A logger includes an interface for an external voltage free contact. The occurrence of an external event causes the logger to wake momentarily, record the event to the historical record, transmit the event on the serial port (if the EV flag is on), update the Total Events and Events Today before going back to sleep.

5.4 Communications Interface

The communications allows for simple direct connection to a PC. The hardware interface is standard RS232, and the low consumption of the MiniLog means that sufficient power can be extracted from the RS232 handshake lines to power the logger while a communication session is in progress. Seven baud rates can be selected.

5.5 Watchdog

The MiniLog incorporates ‘watchdog’ circuitry within the microprocessor to automatically recover from unforeseen software or noise induced failures. The action of a watchdog reset does not affect previously recorded data or any set-up parameters including date and time.

5.6 Power Supply

The MiniLog is powered by an internal AA battery, for normal event logging. This can be anything from an alkaline (1.5V) to a lithium (3.0V or 3.6V) – with each type of battery giving a different life. External power is required during a communication session – but this is normally provided through the RS232 handshake lines when an RS232 cable is connected.

External power may be connected through the DB9 connetor - use 6V DC to 19V DC.

5.7 System Memory

A fundamental requirement of the logger unit is for sufficient memory capacity to store 400,000 events.

In most cases the MiniLog can be returned to the processing centre via surface mail. The

logger's small size and weight means the returned package will conform with low cost postage tariffs.

The logger application requires three essential memory areas, **Data Memory** for storage of the historical records, **Program Memory** for storage of the application firmware and **Parameter Memory** to store unique station parameters.

5.9 System Clock

The clock performance in terms of reliability and maintainable accuracy is of prime importance as the historical record is unusable should time and date errors occur. The clock should maintain an accuracy of better than 20 seconds per month with resolution to one second across an operating temperature range from –10ºC to +70ºC. The Time Adjust command allows for automatic software adjustment of the real time clock crystal.

5.9 Logger Identification

Each logger has a six digit unique identification number hard coded and accessible as a **read** only system parameter via software.

6. MAINTENANCE

Hydrological sites are routinely visited to maintain the sensors. During these visits, you will probably also download data and check the condition of the internal ML1A batteries.

Our recommendation when using lithium batteries in the ML1A:

- If the voltage is 3.2V or lower, then change the batteries immediately.
- If the voltage is 3.3V, and you were coming back in 3 months, then you could probably wait until next time.
- If the voltage is 3.3V, and you were coming back in 6 months, then I would replace the batteries now.
- If the voltage is 3.4V, and you were coming back in 6 months, then you could probably wait until next time.
- Replace the batteries annually to be on the safe side. (This all depends on what your data is worth.)

Our recommendation when using alkaline batteries in the ML1A :

- If the voltage is 1.2V or lower, then change the batteries immediately.
- If the voltage is 1.3V, and you were coming back in 3 months, then you could probably wait until next time.
- If the voltage is 1.3V, and you were coming back in 6 months, then I would replace the batteries now.
- If the voltage is 1.4V, and you were coming back in 6 months, then you could probably wait until next time.
- Replace the batteries annually to be on the safe side. (This all depends on what your data is worth.)

When the ML1A is opened to replace the internal battery, check for internal moisture on the PCB and check the state of the seal around the lid and replace if necessary.

After the battery is replaced, check the date and time to make sure it is correct before leaving the site.

6.1 Fault Finding

This fault finding guide should be used by the ML1A user before they consult the manufacturer to assist with specific problems.

LED does not flash once a second.

- If you have attempted to load new software / firmware, then attempt the procedure again.
- The internal battery may be flat. Remove the 4 screws on the top of the MiniLog and remove the top cover exposing the PCB and battery. Use a DVM to measure the battery voltage. An alkaline battery should be about 1.5V and a lithium battery should be between 3.2V and 3.6V See the previous "Maintenance" section for battery replacement recommendations.
- If LED still does not flash after the above has been checked, return the logger to the supplier for service.

No communications from logger.

- Check if LED flashes when sending a character to the logger. If not, see if the LED flashes in response to an external event. The RS232 handshake lines provide power to the MiniLog – so make sure the RTS and DTR signal are in their hi state – especially if you are using a third party terminal emulation package.
- Check the logger baud rate, number of bits and parity (8/N/1) matches that of the terminal emulation program being used on the computer. If you receive strange characters in response to a carriage return, then the baud rates probably don't match - change the baud rate on the terminal emulation program, and try again.
  Try all 7 baud rates from 1200 to 57600 on the PC.
- Check the Tx, Rx, RTS, DTR and Gnd wiring to the logger from the computer.
- Check that the terminal emulation program is working, by disconnecting the logger and shorting the Tx and Rx wires together, and type on the computer. You should get each character twice on the screen. Try the other available comm ports on the PC.
- Check that you have selected the correct comm port in WinComLog :
  - Remove the USB to RS232 adapter from your PC.
  - Click on the Comm Port drop list and check the list of comm ports.
  - Now plug in the USB to RS232 adapter, and click on the Comm Port drop list again – there should be 1 new comm port – this is the one you need to select.
  - If a new comm port does not appear, then Windows is not recognizing the USB device. You need to make sure the USB device driver is loaded correctly. Consult your IT department.

What I type on the computer the characters do not appear, but the logger seems to respond OK.

- Set the third party terminal emulation program "Local echo" to on.

An external event flashes the LED but nothing gets transmitted.

- Set the event flag (EV) to on to allow events to be transmitted.
- Check that the multiplier (**mm**) in the increment parameter (INC=x.x/**mm**) is set to a reasonable number. Remember that **mm** contact closures represent one event.

When I type <CR> (Enter) on the computer the LED flashes but I get no reply.

- Set the response flag (RE) to on.

The logger will not accept my password.

- Check that you have the correct password, and you are entering it in the correct upper and lower case. The factory default password is "BOMM"
- If still no success, the logger must be returned to the manufacturer, to set a default password. Keep your password written down in a secure place.

When I enter a parameter I just get a "Syntax Error" reply.

- Check the exact command syntax by using the on-line help. Type ?<CR> . Now re-enter the parameter with all leading and trailing zeros.

When I enter a command I just get a "Command Error" reply.

- Check that the command you are entering is a valid command by using the on-line help. Type ?<CR> and check the exact spelling of the command.

The external battery voltage read is lower than I expect at 5.84V .

- The external battery is probably disconnected or completely flat – you are probably seeing the voltage supplied from the RS232 port.

I don't have an external battery, but it is reading 5.84V .

- You are seeing the voltage supplied from the RS232 port – this is normal.

APPENDIX A. SURGE PROTECTION

The ML1A has a limited amount of surge protection on the inputs and outputs. If the equipment is installed in a lightning prone area we recommend installing additional surge protection on cables entering the cabinet housing the ML1A.

Different suppression is required, depending upon the voltage to be protected.

Figure C.1 on the next page show suggested methods of protecting equipment against transients. The transient suppressors and the metal cabinets should also be connected to a solid earth at the site.

(NOTE: HS warranty does not cover equipment damaged by surges or transients !)

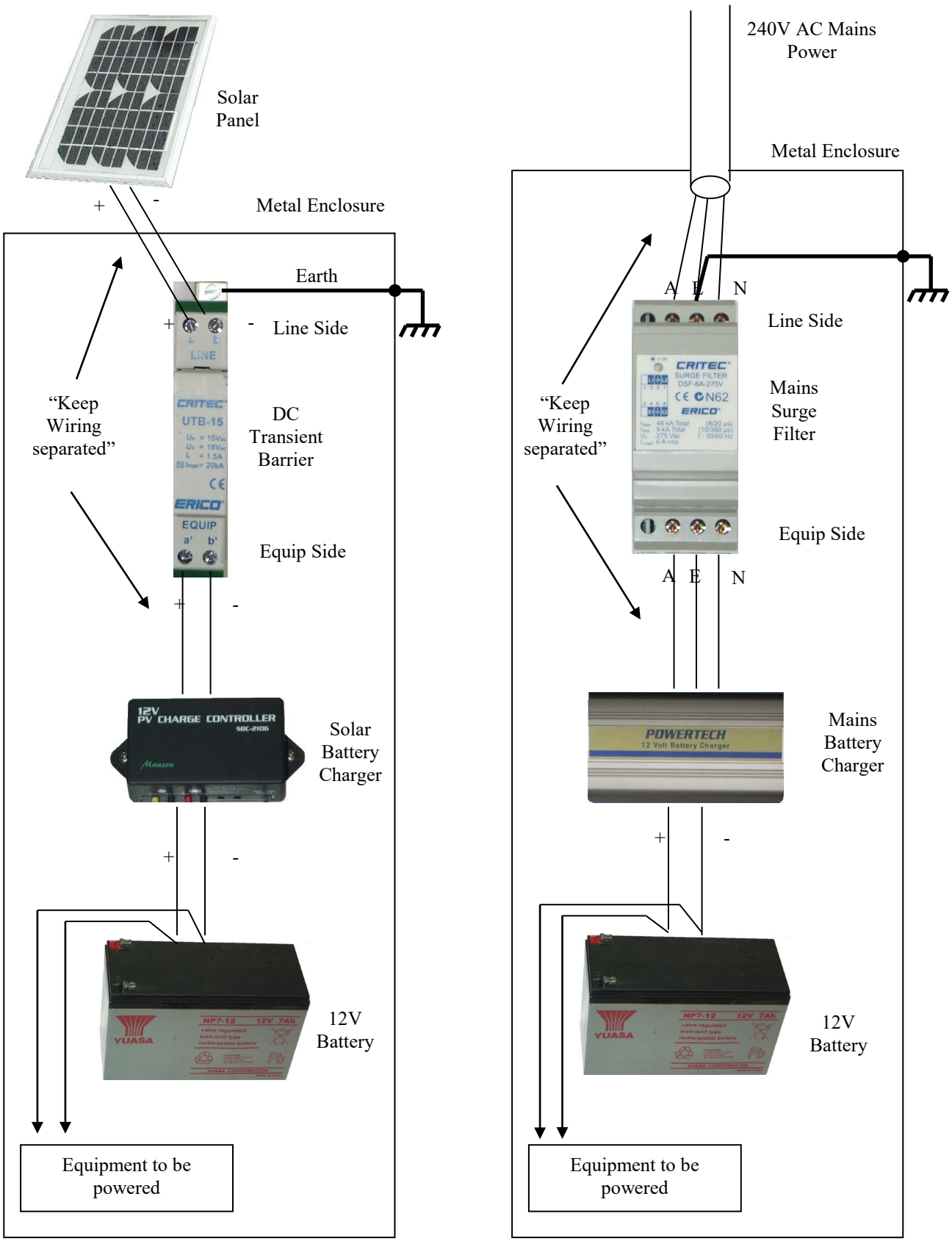


Fig C.1 "Typical solar or mains powered site"