Memory Module

Data Logging Guide

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Terminology

ASCII	American Standard Code for Information Interchange. The encoding method for plain text characters used by serial terminals.
DIP	Dual in-line package. The configuration switch package used by the Avid reader.
FDX	Full duplex. The ISO FDX standards specified in ISO 11785.
ID	Identification number. The unique identification number stored in RFIDs.
ISO	International Organization for Standardization. The governing body for international standards, which includes most RFID standards.
LCD	Liquid crystal display. The display technology used by the Avid add-on display board.
RF	Radio frequency. The type of signals that Avid tags use to provide identity.
RFID	Radio-frequency identification. The type of electronic tag that the Avid readers are designed to read.
RS-232	Recommended Standard 232. The serial port standard used by the Avid reader.
RTC	Real-time clock. This component provides an accurate current time and date reference for the Avid reader.

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1. Introduction to Data Logging with Avid™

The Avid Power Tracker™ III, Power Tracker™ VIII, and Industrial RFID readers have built-in memory and real-time clock (RTC) capabilities. Users can record tag IDs in the reader's internal memory or a computer connected to its serial port.

This document describes the steps and commands to effectively use the Avid data logging features through a serial terminal.

2. Computer Connection

The Avid Power Tracker and Industrial RFID readers can connect to a computer's RS-232 serial port. If your computer does not have a serial port, USB and Bluetooth® adapters are readily available at most electronics stores.

2.1. Serial Communication Port

To communicate with the Avid reader in the factory configuration, your computer's serial port needs to use the following settings:

Bits per second (Baud):	*9600*
Data bits:	*8*
Parity:	*None*
Stop bits:	*1*
Flow control:	*None* or *XON/XOFF*

Note that the commands issued over the serial port will override the hardware DIP switch configuration on your reader, and your reader will remain in the state set by the most recent command until it is restarted from power-off.

Once a serial connection is established, your reader will echo all valid serial commands to the terminal software. Invalid commands will not be echoed.

3. Serial Port Communication

A serial port terminal provides the user interface between the Avid reader and your computer. Numerous terminal software emulators are available for Microsoft® Windows®, Linux®, Google® Android®, Apple® macOS®, and Apple iOS®.

The terminal displays the data and messages received from the reader. It also allows the user to control the reader by entering commands on the console. The examples shown in this document use the open-source Windows software TeraTerm (https://osdn.net/projects/ttssh2/) for illustrations, but users may choose to use any terminal or software that supports standard serial port communications, e.g. CoolTerm by Roger Meier (http://freeware.the-meiers.org/) runs on Microsoft® Windows®, Apple® macOS®, and Linux®.

TeraTerm provides two key features in addition to terminal emulation: logging and text file sending. These two features allow the user to conveniently record the data from the reader and send predefined lookup table entries to the reader.

3.1. Serial Terminal Configuration

Identify the serial port that the Avid reader is using and setup TeraTerm according to your connection by selecting "Setup→Serial port...", as shown in Figures 1 and 2. If timing settings are available, set the transmit delays to *0 ms/character* and *1 ms/line*.

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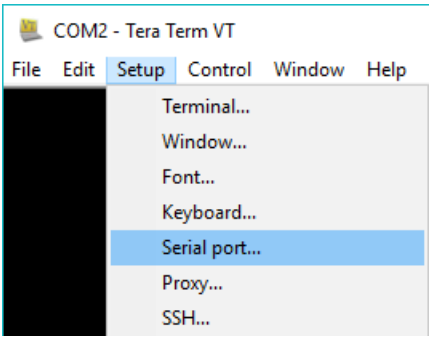

Figure 1: TeraTerm Setup

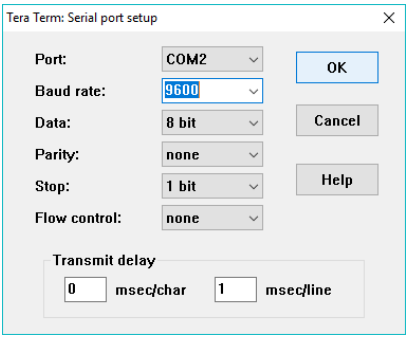

Figure 2: TeraTerm Serial Port Setup

Once the terminal software is setup and connected, you may test the connection by displaying the data logger version number. Sending '=' to the reader will display five lines of reader information to your serial terminal similar to Text 1. The last two items on the # Settings line are the name of the data logging firmware (datasavr.c) and its revision number.

```
# Reader ID      1755 @18011813072286
# Initialized as: Data Saver
# Settings:  q:#Kt1I1l        datasavr.c 1.61
# Last cleared @18012411125914
# Current timestamp @18012411130116
# Remaining: 2000
```

Text 1: Reader Information

The two most common types of reader messages are IDs and prompts. New tag IDs are always immediately sent to the serial terminal and are displayed at the beginning of a new line. By default, the readers will also display prompts like ' LOOKING' and ' NO ID Found' to indicate its status. Status prompts always start with a space character at the beginning of the line. These prompts can be enabled by the 'Q' command and disabled by the 'q' command. The details on the reader control commands can be found in Section 4.

3.2. Data Logging

The Avid readers can log data in two different modes: Data Saver and Lookup.

In Data Saver mode, all the IDs and their corresponding timestamps are stored in the internal memory. The same data are also sent to the serial terminal. Text 2 is an example showing an extraction of the seven tags saved in the reader memory by using the '+' command. Each ID recorded is followed by a timestamp. The time stamp format is described in Section 5.1.

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```
# Reader ID      1755 @18011813072286
# Initialized as: Data Saver
# Settings:  q:#Kt1I1l         datasavr.c 1.61
# Last cleared @18012517000011
# Current timestamp @18012517005422
AVID*070*576*770@18012517000631
AVID*900*000*011@18012517000840
123450002A@18012517001007
7C7C7C7C7C@18012517001217
123450002A@18012517001404
AVID*900*000*011@18012517001569
AVID*070*576*770@18012517001754
# 7 Downloaded
!EOF
```

Text 2: Data Saver Memory

In Lookup mode, only unique IDs and their corresponding lookup table names are stored in the internal memory as shown in Text 3. The table names and sequence numbers found in the internal memory are sent to the serial port in place of the tag ID during logging. While the timestamps are not stored in the lookup tables, they are sent to the serial port together with the table name and sequence number in real-time as shown in Text 4.

```
# Reader ID      1755 @18011813072286
# Initialized as: Lookup
# Settings:  q:#Kt1I1l         datasavr.c 1.61
# Last cleared @18012516085512
# Current timestamp @18012516290166
trial001-0000001,AVID*070*576*770
trial001-0000002,AVID*900*000*011
trial001-0000003,7C7C7C7C7C
trial001-0000004,123450002A
# 4 Downloaded
!EOF
```

Text 3: Lookup Memory

```
trial001-0000001@18012516550839
trial001-0000002@18012516551154
trial001-0000004@18012516551486
trial001-0000003@18012516551548
trial001-0000004@18012516551708
trial001-0000002@18012516551910
trial001-0000001@18012516551954
```

Text 4: Lookup Mode Serial Terminal Output

The ‘+’ command extracts the memory content shown in Text 3. In this example, the extracted memory content is a lookup table with ‘trial001’ as the table name. Each table entry contains the table name, the table entry sequence number, and

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the tag ID. The details of this table format is described in Section 5.4. Since the memory does not store timestamps in Lookup mode, a complete activity log also requires real-time logging of the serial port output. Text 4 illustrates the serial terminal output in Lookup mode where the table name and sequence number with the timestamp are shown.

The data outputs in both Data Saver and Lookup modes are summarized in Table 1. Note that switching between data logging modes erases the current memory. Make sure that the reader data are downloaded before switching modes.

Mode	Reader Memory	Serial Terminal
Data Saver	ID and timestamp.	ID and timestamp.
Lookup	Lookup table name, index, and unique ID.	Lookup table name, index, and timestamp.

Table 1: Data Logging Modes

3.3. Read History Extraction

To extract the memory content from the reader, create a terminal log in TeraTerm by selecting “File→Log...” and entering the new filename to be used for data storage as shown in Figures 3 and 4.

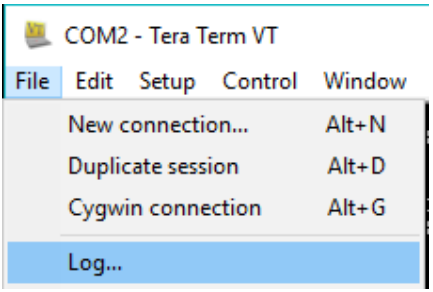

Figure 3: Create Data File

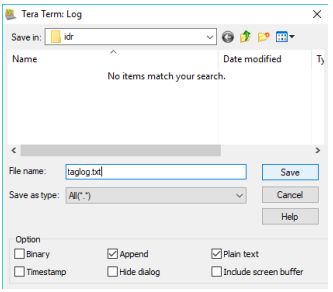

Figure 4: Specify Data Filename

Once a terminal log is created, enter the ‘+’ key in the terminal to initiate the data transfer from the reader. The reader sends the string ‘**! EOF’** at the end of a data transfer session. When the transfer is completed, select “File→Show log dialog...” to save the terminal log as shown in Figures 5 and 6. All the recorded tags and their corresponding timestamps are then saved in the terminal log file.

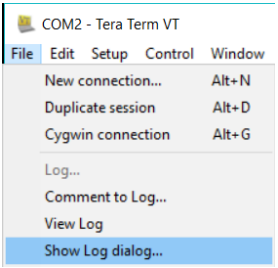

Figure 5: Close Data File Dialog

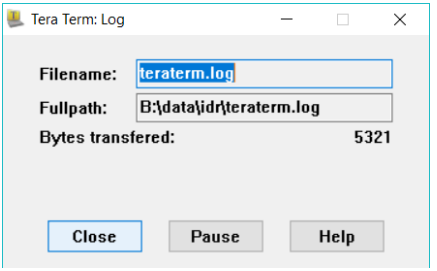

Figure 6: Save and Close Data File

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3.4. Lookup Table Definition

The data logger supports a maximum of 32 lookup tables in memory. Lookup tables can be created with one of these two methods: reader learning and predefined upload.

3.4.1. Reader Learning

To create a lookup table using reader's learning feature, send the 'l' (lower case L) command followed by a table name with at most eight characters and a line terminator, e.g. entering *ltrial001* (followed by the *Enter* key) creates a lookup table named *trial001*. This activates Reader Learning. When a new tag is read, the reader assigns a new sequence number for the tag and creates a new table entry for it. No new entry is created for any tag that already exists in the lookup table memory, but the table name and the ID's corresponding sequence number will still be sent to the serial terminal with a timestamp.

To stop learning, send the 'l' (lower case L) command followed by the *Enter* key to the reader and no new entry will be added to the reader's lookup tables.

Sending 'l' followed by a table name different from the current one instructs the reader to start learning about tags for that new table.

3.4.2. Predefined Table Entry

Predefined lookup table entries can be sent to the reader through the serial interface. The entries can be manually entered on the terminal or sent in a batch using a text file. Table entries must follow the format shown in Text 5. Note that the Avid reader may not support all the tag standards, please refer to your reader's user manual to confirm compatibility.

<table name>-<sequence number>,<tag>

where

<table name> is an eight-character table name, e.g. testrun0. Note that table names cannot start with the space character ' '.

<sequence number> is a 7-digit, positive integer

<tag> is the ID assigned for this lookup table entry, e.g. AVID*070*576*770. Accepted formats include all standard Avid, FECAVA, ISO FDX, and Trovan ID formats.

Text 5: Lookup Table Entry Format

To manually enter a lookup table, send the '^' command to the reader and start entering the lookup table entries. When all entries are entered, exit the upload mode by sending the '!' command. To check the tables, send the '+' command and the reader will respond with the list of current table entries.

The lookup tables can also be uploaded as a text file in the format shown in Text 6. Text 6 defines four entries for the *trial001* table. It is identical to Text 3 except for the extra '^' character at the beginning of the file. Uploading this text file to an Avid reader is equivalent to reading the four tags *AVID*070*576*770*, *AVID*900*000*011*, *7C7C7C7C7C*, and *123450002A* in Reader Learning mode. During table entry, lines beginning with a '#' character are ignored by the reader, but when the reader is not in the table entry state, the '#' character is the command to enable the three-minute idle warning beep.

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```
^
# Reader ID      1755 @18011813072286
# Initialized as: Lookup
# Settings:  q:#Kt1I1l          datasavr.c 1.61
# Last cleared @18012516085512
# Current timestamp @18012516290166
trial001-0000001,AVID*070*576*770
trial001-0000002,AVID*900*000*011
trial001-0000003,7C7C7C7C7C
trial001-0000004,123450002A
# 4 Downloaded
!EOF
```

Text 6: Lookup Table Definition File, *lut.txt*

To upload a predefined lookup table with TeraTerm, select “File→Send file...” and open your lookup table definition file in the dialog as shown in Figures 7 and 8.

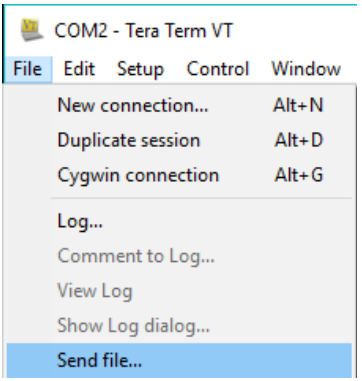

Figure 7: TeraTerm Send File Menu

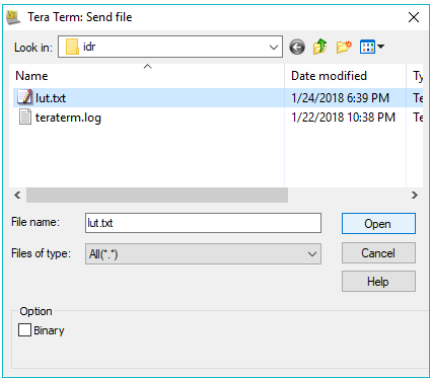

Figure 8: TeraTerm Send File Dialog

3.4.3. Table Entry Errors

The reader will ignore a new entry and display an error prompt on the terminal in one of the following four conditions:

1. The reader already has 32 tables and the user attempts to create a new table. The data logger can have a maximum of 32 tables in memory. New table cannot be created after the 32nd table.
2. A table entry with the same sequence number already exists. A valid entry in a lookup table cannot be replaced.
3. An entry with the same tag ID is already in memory. Every tag ID in memory is unique. An ID cannot exist in more than one table.
4. Tag ID format is invalid. The data logger only accepts standard Avid, FECAVA, ISO FDX, and Trovan tag ID formats.

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4. Data Logger Commands

Commands are case-sensitive. An uppercase ‘C’ is a different command from a lowercase ‘c’. In general, uppercase commands enable features, and lowercase commands disable them. The following is a list of commands accepted by the Avid data logging firmware.

Notations:

[NV] This command changes the reader configuration memory. The change is saved by the reader for subsequent operations.

[PT8] This command only affects the Power Tracker VIII.

R	Read. Start looking for tags.
S	Stop. Stop looking for tags.
C or **M**	Enable continuous reading. Start looking for tags and continue looking after one is found. On readers equipped with LED read indicators, the LED will flash as long as a valid tag is present.
c or **m**	Disable continuous reading. Reading continues until a valid tag is read or when a stop command is received by the reader.
(space) or **x**	Toggle between Read and Stop.
B	[NV] Enable the reading and message beeps.
b	[NV] Disable the reading and message beeps.
Q	[NV] Stop sending prompts to the serial port. Tag ID information is still sent.
q	[NV] Start sending prompts to the serial port.
:	[NV] Use CR/LF for prompt and tag line termination.
;	[NV] Use LF for prompt and tag line termination. To be used with Linux.
$	[PT8][NV] Disable the 3 minute idle warning beep.
#	[PT8][NV] Enable the 3 minute idle warning beep.
W	Write up to 16 characters to the LCD. More than 16 characters or a control character (such as CR) will terminate the command.
A	[PT8][NV] Enable the Ack/Nak/Status. The reader will also respond with an ‘N’ when an unrecognized command is received.
a	[PT8][NV] Disable the Ack/Nak/Status.
Z	[PT8][NV] Enable Departure Reporting. When a tag leaves the detection range of the reader, a prompt is sent to the terminal, e.g. “ Departed 999.0123456789012”.
z	[PT8][NV] Disable the Departure Reporting.
I	(uppercase i)[PT8][NV] ISO format: `0999123456789012`
i	[PT8][NV] ISO format: `999.123456789012`
I0	(uppercase i, zero)[PT8][NV] ISO format: `999.123456789012`
I1	(uppercase i, one)[PT8][NV] ISO format: `0999123456789012`
I2	(uppercase i, two)[PT8][NV] ISO format: `3E7.1234ABCDEF`
I3	(uppercase i, three)[PT8][NV] ISO format: `999123456789012`

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Note: In continuous reading mode, if a tag in the field, changing the output format will cause the same tag ID to be sent again using the new format. If Departure Reporting is enabled, both the departure message for the tag in the old format and the read message for the same tag in the new format will be sent.

= Send the reader's header information to the serial port. See Section 5.2.

+ Send the reader's header information and the current stored tags to the serial port.

----- (five hyphens) Clear ID memory.

K [PT8][NV] Allow all menu items to be accessed by the keypad.

k [PT8][NV] Limit menu items on the keypad to Show Memory, Reader ID #, and Quit.

L0 [NV] Initialize reader in DataSaver mode, clearing ID memory.

L1 [NV] Initialize reader in Lookup mode, clearing ID memory.

^ Enter upload mode. See Section 3.4.

! Exit upload mode.

U [NV] Set the reader ID. Enter the new reader ID immediately after 'U'. A reader ID can be any positive integer up to 9 digits long.

D [NV] Set the current RTC date. Enter the new date in the DDMMYY 6-digit format immediately after 'D'.

DD = day of month

MM = month of year

YY = year

Date values are not checked, e.g. D310218 sets the date to Feb 31, 2018.

T [NV] Set the current RTC time. Enter the new time in the Hhmmss 6-digit format immediately after 'T'.

HH = Hour of day, 0-24

mm= Minute of hour, 0-59

ss = Second of minute, 0-59

Time values are not checked.

l (lowercase L)[NV] Stop Reader Learning in Lookup mode.

lnnnnnnnn (lowercase L)[NV] Start learning entries for Table **nnnnnnnn**, where **nnnnnnnn** is an 8-character table name. The table name cannot be longer than 8 characters. Entering more than 8 characters turns off the Reader Learning mode.

t0 [NV] Disable timestamps in serial port outputs.

t1 [NV] Enable timestamps in serial port outputs.

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5. Data Formats and Manipulation

The Avid serial port outputs contain specialized data formats. The section provides the essential information to understanding the data and developing software for interfacing with the Avid reader.

5.1. Timestamp

Timestamps are used in data logs and ‘real time’ serial terminal outputs. All Avid timestamps are formulated with an ‘@’ character followed by a 14-digit numeric time code. The following string summarizes the timestamp format:

@YYMMDDHHmmsshh

where

YY	last two digits of the year
MM	month
DD	day of the month
HH	hour in 24-hour clock formatted
mm	minute
ss	second
hh	1/100th of a second

Sorting by the timestamp string or its numeric value will arrange the table entries in chronological order. Care must be taken when importing the 14-digit time code as it requires up to 47 bits to represent without losing precision.

The reader takes longer than one hundredth of a second to read a tag and timestamp it for display, so the timestamp has a small variable delay from the exact time when the tag is read; however, a larger timestamp value always indicates that the tag ID is read at a later time.

5.2. Log Header and Trailer

The data logs for the Data Saver and Lookup modes start with five ‘header’ lines similar to the text below:

```
# Reader ID 9999999999@02122615423624
# Initialized as: Data Saver
# Settings:  q:#Kt1I0l          datasavr.c 1.XX
# Last cleared @02122611323648
# Current timestamp @02122611340199
```

And these logs always end with two ‘Trailer’ lines similar to the text below:

```
# 5 Downloaded
!EOF
```

Each line in the header and trailer are explained in details in the following paragraphs:

 # Reader ID

The Reader ID is a positive integer stored in the memory card. The Reader ID is always followed by a timestamp that indicates the time at which it was assigned. By default, the Reader ID is set to the reader's serial number at assembly time.

In the outputs, the ‘# Reader ID’ string is followed by an ID number up to nine digits long and an Avid timestamp. A 10-character space is reserved for the ID

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number and the ID is right-justified, which leaves the leading spaces empty. Since the maximum number of Reader ID digits is nine, there is at least one space preceding the ID. For example:

```
# Reader ID          1@01010112010100
```

In this example there are nine spaces before the Reader ID of 1, which was stored in the reader on Jan 1, 2001, at 12:01:01.00 PM.

 # Initialized as:

The '#Initialized as:' string is followed by a space and the logging mode, which can either be 'Data Saver' or 'Lookup'.

 # Settings:

The 'Settings:' string is followed by a list of characters that represents the reader's current state. This list of characters are a subset of the commands described described in Section 4. The reader firmware and version number are displayed after this command list. In the output, '# Settings:' should be followed by a space and a combination of the state characters, which are then followed by the logger firmware name and version number. The following are the possible state characters:

Q or **q**	for Quiet mode on or off.
; or **:**	for LF only or CR/LF line termination.
# or **$**	for 3-minute idle warning beep on or off.
K or **k**	for full keypad menu access enable or disable.
t1 or **t0**	for serial port timestamp enable or disable.
I0, **I1, I2** or **I3**	(uppercase i) for ISO FDX-B tag output format.
lnnnnnnnn	(lowercase L) where nnnnnnnn is the 8-character table name if the reader is learning new tags for a table. If the reader is not learning, then eight spaces are shown after 'l'.

 # Last cleared

The 'Last cleared' line has a timestamp that indicates when the reader log was last cleared. Clearing the reader memory or initializing the reader to a logging mode updates this timestamp. All the tag ID entries recorded in the Data Saver mode should be newer than the 'Last cleared' timestamp if the RTC's date and time have not been changed by the user.

 # Current timestamp

The 'Current timestamp' line has a timestamp that indicates the time at begging of the data download. All the tag ID entries recorded in the Data Saver mode should be older than the 'Current timestamp' if the RTC's date and time have not been changed by the user.

 # (Number) Downloaded

The 'Downloaded' line indicates the number of tag ID entries that was extracted from the reader's memory.

!EOF

The '!EOF' line indicates the end of a data download.

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5.3. Data Saver Log

Data Saver log entries are composed of the tag ID followed by its timestamp. The tag IDs can have different lengths and are listed in chronological order. The following is a sample of the Data Saver log extracted from the reader:

```
# Reader ID 9999999999@02122615423624
# Initialized as: Data Saver
# Settings:  q:#Kt1I0l         datasavr.c 1.XX
# Last cleared @02122611323648
# Current timestamp @02122611340199
131629152A@02122611332309
AVID*123*456*789@02122611332371
131629152A@02122611332434
131629152A@02122611332505
131629152A@02122611332580
# 5 Downloaded
! EOF
```

5.4. Lookup Log

In the Lookup mode, the reader memory is used to store lookup tables that have unique tag IDs. The Lookup mode table entries are composed of information arranged in the following format:

<8-character table name>-<7-digit sequence number>,<Up to 16 characters of tag ID>

These table entries can be treated as comma delimited pairs where the first field is the table entry sequence number and the second field is the corresponding tag ID. While the sequence numbers are unique within a table, multiple tables can have the same sequence numbers; therefore, the table name and sequence numbers need to be treated as a pair to uniquely identify an ID entry.

```
# Reader ID         1 @02122615423624
# Initialized as: Lookup
# Settings:  q:#Kt1I0lTstStudy datasavr.c 1.XX
# Last cleared @02122615430625
# Current timestamp @02122615451303
TstStudy-0000001,AVID*123*456*789
TstStudy-0000002,131629153A
TstStudy-0000003,131629154A
TstStudy-0000004,131629155A
TstStudy-0000005,131629156A
# 5 Downloaded
!EOF
```

5.5. Data Manipulation

Data captured by terminal emulators are ASCII text files. The data can be directly imported with most office software and script languages. This section describes how the data logs can be used in common office software.

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Text Editors

Avid data logs are compatible with most text editors. In Microsoft® Windows®, Notepad® and WordPad® can be used to edit data and lookup table definition files.

Spreadsheets

Spreadsheet programs like the Microsoft® Excel® can import the Data Saver and Lookup logs as ‘delimited’ text tables.
In Data Saver logs, the delimiter is the ‘@’ character at the beginning of the timestamp.

In Lookup logs, use the ‘,’ character as the delimiter to separate the table sequence number from the tag ID. It is possible use the ‘-’ character as a delimiter as well, to split the table name from the sequence number.

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6. Avid Contacts

You can reach Avid customer service representatives by phone:

+1-800-336-2843

+1-951-371-7505

or by email:

support@avidid.com

Should the reader need to be returned to Avid, request a Return Material Authorization (RMA) number from Avid before return shipping.

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