



RTU/EFM

User configurable reports instructions

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Revision History

Revision	Date
01	02-01-2023

1. Summary

With the expansion of the RTU/EFM product line into the liquid market it has been recognized that the hard coded report formats that have existed in the AutoEXEC unit are not flexible or capable of providing all of the various information that users in this market have requested. Users have required more and more custom versions of AutoEXEC just to provide the report in the formats and with the user specific information that they require in their daily operations. The implementation of the User Configurable Reporting feature is intended to provide end users with the ability to generate custom reports in the AutoSERIES AutoPILOT PRO, AutoXP, and AutoFLEX) product line.

The overall goal for the User Configurable report is to provide separate formatted reports on different communications channels independent of each other. Reports should normally be dedicated to each communications channel. If identical reports are to be printed on separate communications channels, then two separate reports should be created both using identical templates to avoid conflicts between port drivers.

The Report table (#102) will be selected as a "Master" table from the Table #96 communications tables, just like a MODBUS Master or Ultrasonic etc tables. The communications driver will call the report processing function. The report function will check if it is enabled and check for a manual "force" request or if it is time to print the report based on the user configured frequency and report type. A "Legacy" printer selection will be available in the table to print reports from the AutoEXEC to the existing Ethernet and USB printers. The AutoConfig will have the ability of requesting a report and uploading the resultant formatted report. As mentioned earlier, the Configurable report will have the ability to be printed from the Ethernet or serial ports via the current Master functionality that is currently used for MODBUS, Tank Gauge, Ultrasonic, etc Mastering. The reports can also be sent out the AutoEXEC's USB and Ethernet port using the existing printer option in the control table and a printer selection that will be available in each configurable report.

2. Parameter Definitions

The Configurable Report offers the user with various parameters with which to configure and control the generation of the report. These parameters are as follows:

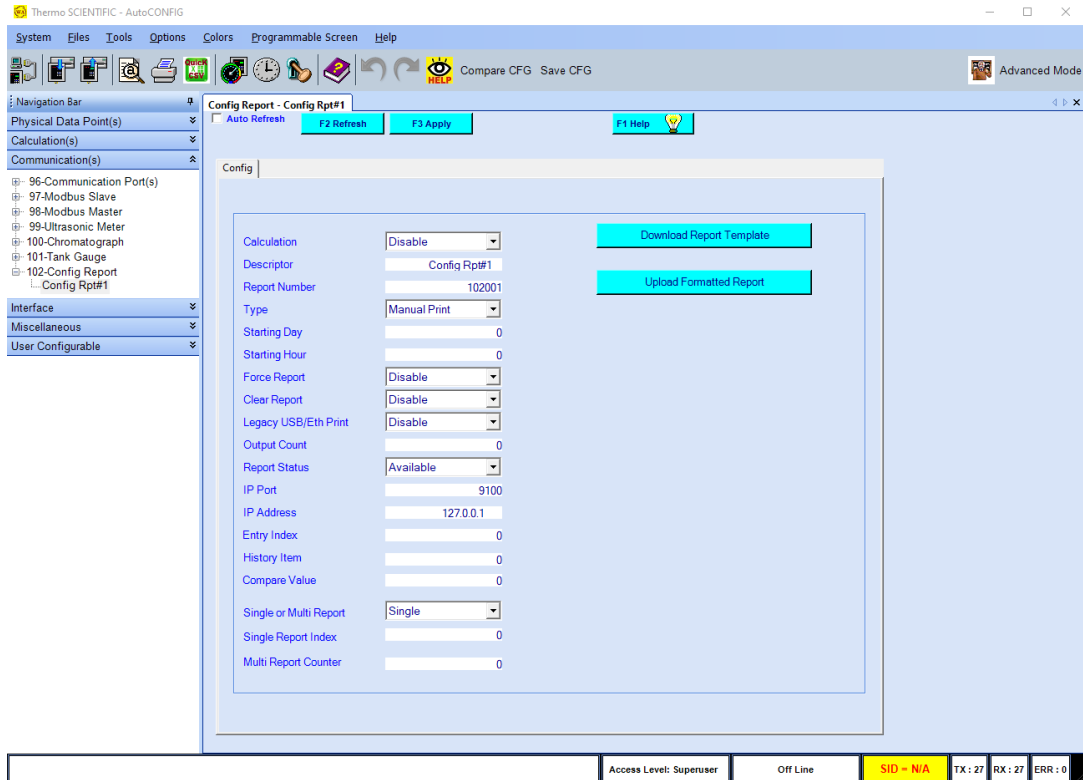


Figure 1. Configurable Report

1. **Enable:** Enables or Disables the processing of this User Configurable report.
2. **Descriptor:** A user changeable label for this report.
3. **Report Number:** Floating point numeric label associated with this report.
4. **Report Type:** Various intervals at which the reports can be generated at and has the following definitions:
 - a. Manual Print
 - b. 1 Minute
 - c. 5 Minutes
 - d. 10 Minutes
 - e. 15 Minutes

- f. 20 Minutes
 - g. 30 Minutes
 - h. 1 Hour
 - i. 2 Hours
 - j. 3 Hours
 - k. 4 Hours
 - l. 6 Hours
 - m. 12 Hours
 - n. Daily
 - o. Monthly
5. **Starting Day:** Day of the month at which a monthly report will print (1 to 31).
 6. **Starting Hour:** Starting hour at which a daily and monthly report will print (0 to 23).
 7. **Force Report:** Flag provides a method of forcing a report to be generated and output at any time (0-Disabled: 1-Force Report).
 8. **Clear Report:** Flag that provides a method of clearing/deleting a stored ASCII report template (0- Disabled: 1-Clear Report).
 9. **Legacy USB/EthPrint:** Flag that provides a means to associate a User Configurable report with the Legacy USB/Ethernet printing capabilities. (0- Disabled: 1-Use Legacy Printing).
 10. **Output Count:** Current number of formatted ASCII characters available for output to a printing device driver or the AutoConfig PC software for uploading during the report generation sequence.
 11. **Report Status:** Boolean that indicates if the report is available for printing or is in the process or printing a report (0-Available: 1-Busy).
 12. **Port Number:** IP port number for Ethernet based printers (Default value 9100).
 13. **IP Address:** Port number for Ethernet based printers.
 14. **Entry Index:** Index for History Log Record Selection (Future Implementation).
 15. **History Item:** History Item within Record for use with compare.
 16. **Compare Value:** Compare reference when searching through history Records.
 17. **Single or Multi Report:** User can generate reports using the index or index counter with the “?” character in the report templates
 18. **Single Report Index:** If Single Report is selected, which Meter Run or Table Index to substitute for the “?” character in report templates.
 19. **Multi Report Counter:** If Multi Reports is selected, this counter generates reports from 1 to N (This counter reports) for the user

3. Template Commands

The user will have the ability to define their own custom reports by means of a ASCII based report template scripting commands. This scripting commands are intended to be intermingled within regular ASCII text. The commands are delineated by 2 reserved ASCII characters "<" and ">". The "<" character denotes when to begin the special parsing of a command and the ">" character denotes when to end the parsing. The commands available to the user allow for the placement of live, calculated, static, status, historical, event, etc, information from the RTU into reports. Commands available to the user consists of, but may not be limited to, the following:

1. Print Point Reference Item
2. Print Binary Text Item
3. Print Average Variable
4. Print Summation Variable
5. Print History Variable
6. Print ASCII String Table Item
7. Print History Date or Time
8. Print Global Date or Time
9. Print Event Audits or Alarms
10. Print Repeating Character
11. Read History Record
12. Zero Averaging Variable Array
13. Zero Summing Variable Array
14. Form Feed Character
15. Line Feed Character
16. Report End

3.1 Syntax for Scripting Commands

The template is an ASCII text file that fully defines the format and content for each report. Each line of the template will include the text to be printed along with the format for each of the printed items. Associated with each formatted text item will be information that will define the source of the item to be printed and some additional codes that will determine any operation that will be performed.

The information for each printed item will be defined within the < > characters of the text.

Special Control Characters

<FF> Form Feed Character

<LF> Line Feed Character

<ZA> Zero Averaging Variable Array

<ZS> Zero Summing Variable Array

<X> Report End

The 1st Character after the < character determines the function to be performed as follows:

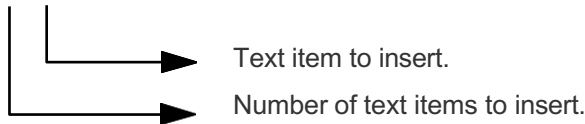
- A:** Print Average Variable
- B:** Print Binary Text Item
- H:** Print History Variable
- P:** Print Point Reference Item
- R:** Read History Record
- S:** Print Summation Variable
- T:** Print Table #15 Text Item
- D:** Print History Date or Time
- G:** Print Global Date or Time
- E:** Print Event Audits or Alarms
- I:** Print Repetitious Character

Each function is expanded in the following pages

1. Repeating Character Item - I

In the case of repetitious character items this command can be used to insert the desired number of any ASCII character into a report. This command can make report templates with repetitious characters much more compact in size.

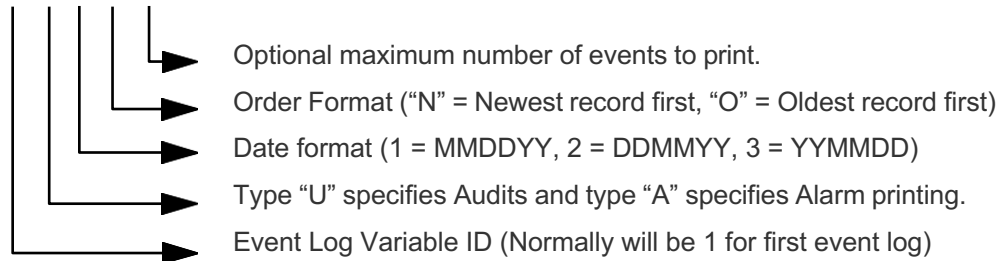
<In, C>



2. Event Record Item - E

For the designated event logs all events up to the maximum (all of not specified) will be formatted as follows.

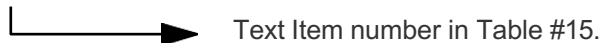
<En, T, F, O, M>



3. Text Variables - T

In the case if Table #15 text information needs to be printed on a report the following format will be used.

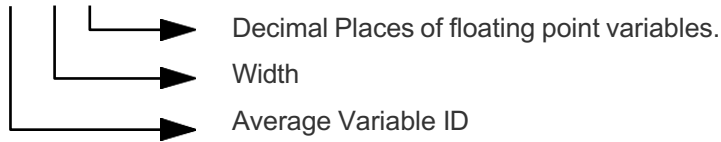
<TII>



4. Average Variables - A

Up to 32 double precision averaging variables are defined within the report generator. These variables can be assigned to any point reference item to be printed so that averaging can be performed on data within the report.

<An, W, D> Average Variable n where n is a value between 1 and 32.



“An” appended to the end of a point reference/History variable indicates that the value is to be used in the calculation of Average Variable n.

Note: A maximum of 32 Averages can be calculated on a single report.

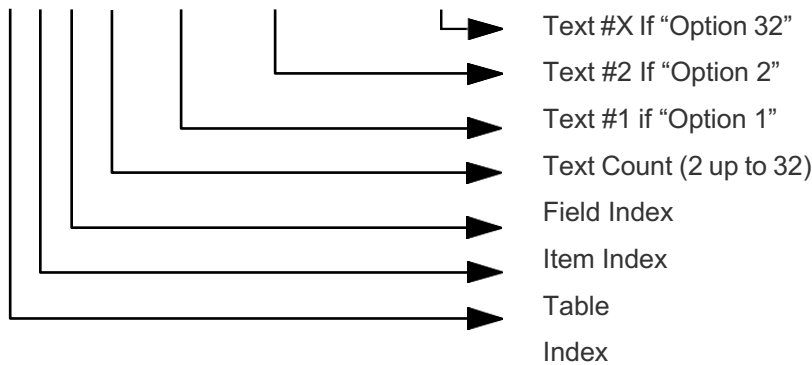
Note: The average will be a running sum of the individual averages and then the value printed will be that running summation divided by the number of total averages summed up to that point.

Note: This function relies on the use of the “History Record Item” (<H...> described further below) being used prior to the usage of this command or point reference item. In addition, “regular” individual point reference values can be averaged as well.

5. Enum Text Item - B

In cases where text is to be printed depending upon a value (Initial/Final Batch report text) the following function can be performed:

<B0, TI, II, FI, XX, “Text1”, “Text2”,....., “Text32”>



B0 = Use Point Reference for Enum Text Item

Source. Example:

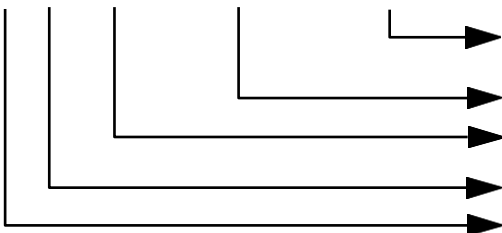
Batch Report: <B0, 46, 1, 5, 2, “Un-Official”, “Official”>

In the above case if the table entry 46 Item Index 1 Field Index 5 is 1 then the report generator will print “Official”. If the value is 0 then “Un-Official” will be printed. If the number is any other number, it will generate an error.

Test Value: <B0, 1, 1, 4, 8, “Zero”, “One”, “Two”, “Three”, “Four”, “Five”, “Six”, “Seven”>

In the above case if the table entry 1 Item Index 1 Field Index 4 is 0 through 7 then the report generator will print the corresponding verbiage for that number. If the number is any other number, it will generate an error.

<B1, nn, XX, “Text1”, “Text2”,....., “Text32”>



Source.

B1 = Use History item for Enum Text Item

T
e
x
t

2”

Text #1 if “Option 1”

Text Count (2 up to 32)

History Item nn

X

I
f

“
O
p
t
i
o
n

3
2
”

T
e
x
t

2

I
f

“
O
p
t
i
o
n

Example:

Batch Report: <B1, 1, 2, "Un-Official", "Official">

In the above case if the History Variable H1 is set to 1 then the report generator will print "Official". If the value is 0 then "Un-Official" will be printed. If the number is any other number, it will generate an error.

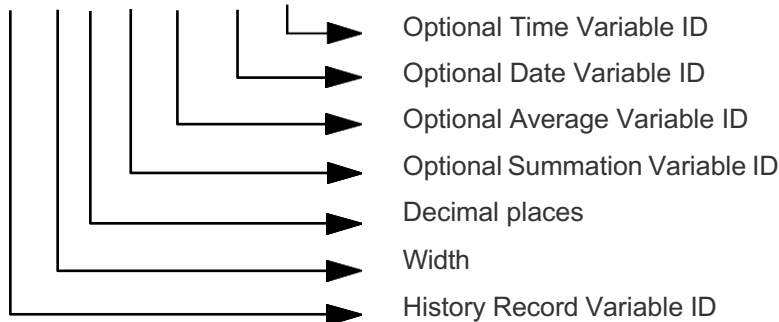
Test Value: <B1, 12, 8, "Zero", "One", "Two", "Three", "Four", "Five", "Six", "Seven">

In the above case if the History Variable H12 is set to 0 through 7 then the report generator will print the corresponding verbiage for that number. If the number is any other number, it will generate an error.

6. History Record Item - Hn

Up to 40 floating point variables are defined within the report generator. These variables are populated after performing a Read History Record operation. The following command can be used to place one of the 40 history record item entries into the printed report.

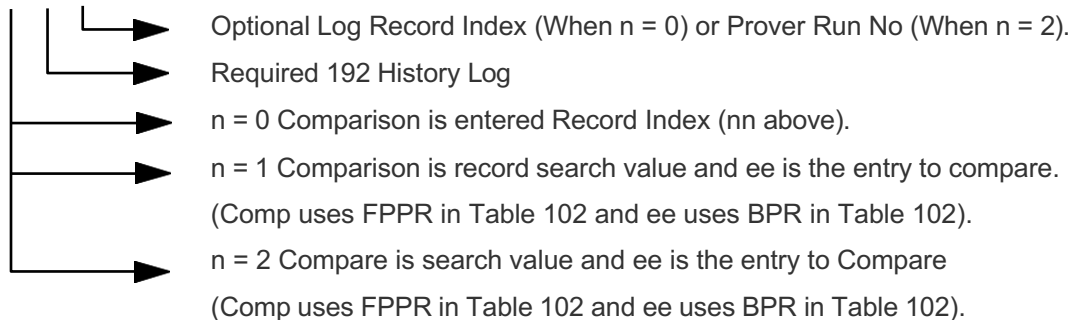
<Hn, W, D, Sn | An | Dn | Tn> History Record Variable n where n is a value between 1 and 40.



7. Read History Record - R

In cases where the report requires various items from a history record to be printed the following command can be used to populate up to 40 History variables from within a history log record as follows:

<Rn, ll, nn>



Example:

Read Hourly Log Record

<R0, 43, 10>

The function call will define the day for which the hourly record is required.

The report generator will go to History log 192, 43 (Meter Run #1 Hourly Log) and search for Index 10 of the requested Hourly Log. The record entry will then be read and up to 40 associated Historical Variables will be populated. Each history variable can then be used in the report.

Daily Log Record Item

<R0, 44, 10>

The function call will define the month for which the daily record is required.

The report generator will go to History log 192, 44 (Meter Run #1 Daily Log) and search for Index 10 on the requested Daily Log. The record entry will then be read and up to 40 associated Historical Variables will be populated. Each history variable can then be used in the report.

Read Batch Log using Batch Number as Search Item

<R1, 39>

In this example the function call will define the Log containing the Batch Information to be printed. In this case we will be printing a Batch Report for Liquid Meter #1.

In order to select the correct batch report to be printed from within the history log the user must first select the History record item that will be used for the search routine to select the required report.

For example, if the batch report history is setup to have Batch Number as field entry #2 then the Table 102 entry Hist_Item should be set to 2. This will tell the report generator to look at Field entry #2 within each record when searching for the correct batch report to be printed.

Finally the required batch number for the report should be entered into Table 102 Compare_Value to allow the search algorithm to retrieve data for the correct batch number.

The correct record entry from within the Meter Run Batch Log will then be searched for and History Variables read for use in the report.

Request Prove Meter Run #1 History for Required Prove Sequence Number

<R2, 43, 0>

In this example the function call will define the Log containing the requested Prover Run information to be printed. Here we will be printing Prover run Information for run #1 of a required prove report for Meter #1 (Prove Runs start with index 0).

The function call will define the Log containing the Prove Meter Run Information and the run number to be printed (In the above case run #1).

In order to select the correct Prove report for the required run the requested Prove Report Sequence Number must be written to Table 102 Compare Value.

Finally the required Field within the prove run log containing the run information must be written to Hist_Item to use as the search for the field within each prove run history record to be compared.

After this has been setup, the report generator will go to History Log 192, 43 (Meter Run #1 Prove Run Log) and use Table 102 Compare_Value and Table 102 Hist_Item to search for Prove Run #1 in the correct Prove Sequence Number Record.

The record entry will then be read and up to 40 associated Historical Variables will be populated. Each history variable can then be used in the report.

Note: Function R2 is only used when reading individual prove runs for a prove report.

8. History Date – DD

To print the date of a historical record read by command “R”.

<DII>

└─▶ History Date format (1, 2, or 3)

1 = MMDDYY

2 = DDMMYY

3 = YYMMDD

9. History Time – DT

To print the time of a historical record read by command “R”.

<DT>

└─▶ History Time

10. Global Date – GD

To print the system date.

<GI>

└─▶ System Date format (1, 2, or 3)

1 = MMDDYY

2 = DDMMYY

3 = YYMMDD

11. Global Time – GT

To print the system time.

<GT>

└─▶ System Time

12. Point Reference Item ID - P

<PTI, II, FI, W, D, Sn | An | Dn | T> Point Reference Table Index, Item Index, Field Index

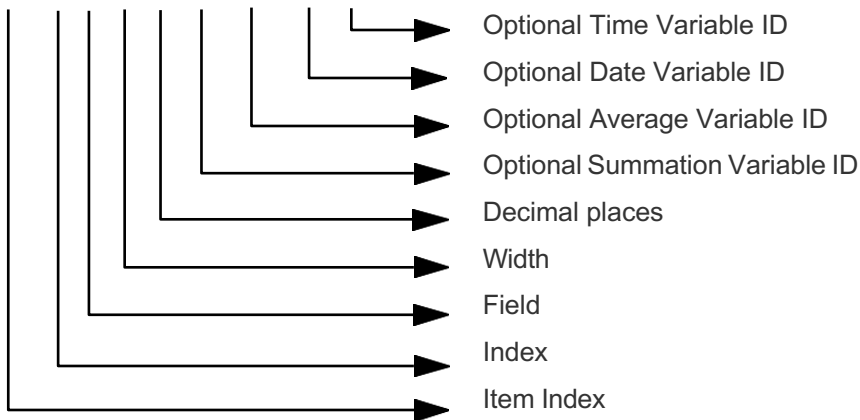


Table Index * Value of -1 in II indicates a run dependent item.

Note: Sn or An can be appended to the point reference to include the value in a summation or average calculation the result of which will be used elsewhere in the report.

Date Format: 1 = MMDDYY

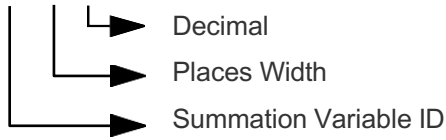
2 = DDMMYY

3 = YYMMDD

13. Summation Variable - S

Up to 32 double precision summation variables are defined within the report generator. These variables can be assigned to any point reference item to be printed so that summation can be performed on data within the report.

<Sn, W, D> Summation Variable n where n is a value between 1 and 32.



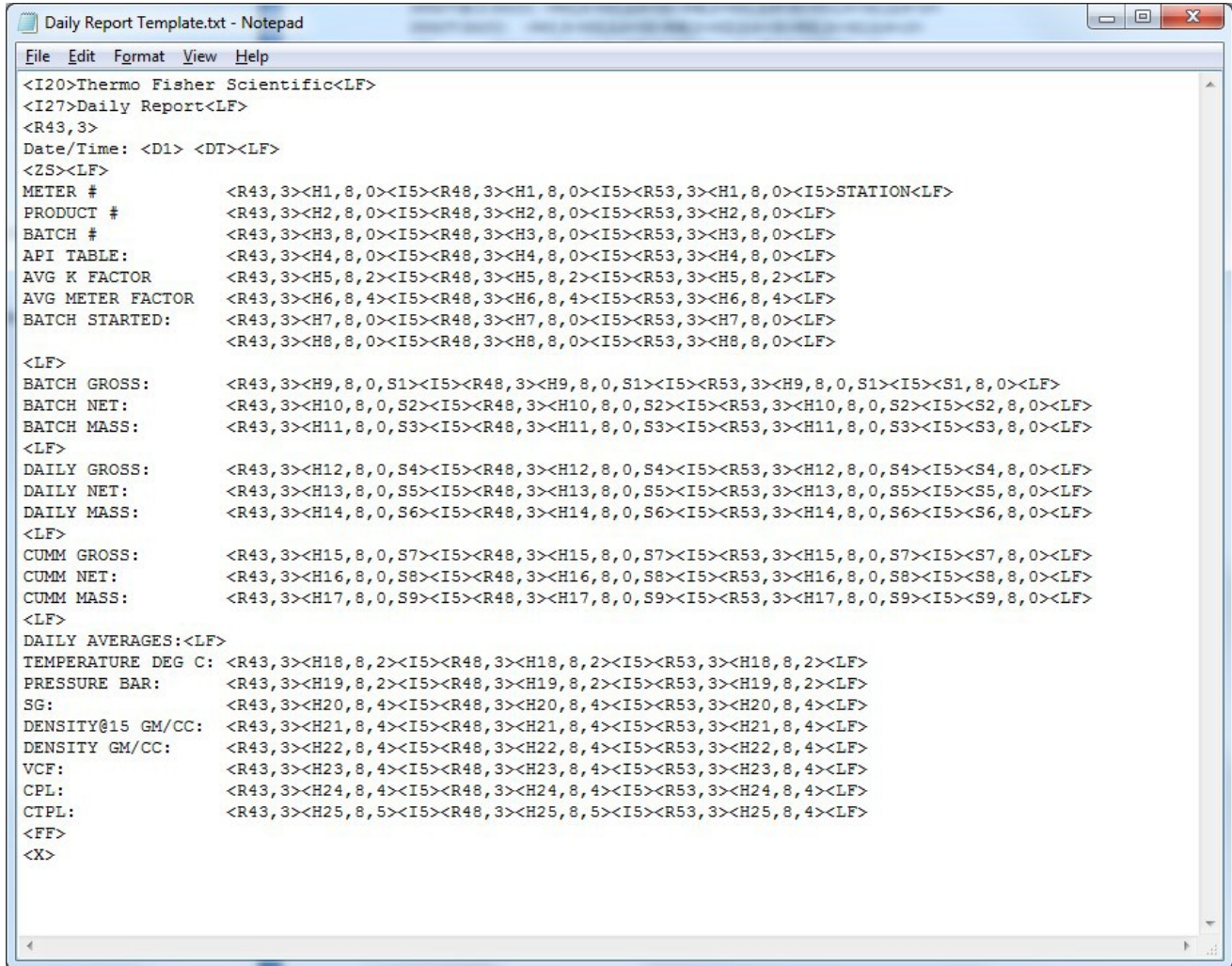
Sn appended to the end of a point reference indicates that the value is to be summated into Summation Variable n.

Note: A maximum of 32 summation variables can be calculated on a single report.

Note: This function relies on the use of the “History Record Item” (<H...> described previously) being used prior to the usage of this command. In addition, “regular” individual point reference values can be averaged as well.

4. Template Examples and Resultant Formatted Reports

Example Daily Report - Template



```
File Edit Format View Help
<I20>Thermo Fisher Scientific<LF>
<I27>Daily Report<LF>
<R43,3>
Date/Time: <D1> <DT><LF>
<ZS><LF>
METER # <R43,3><H1,8,0><I5><R48,3><H1,8,0><I5><R53,3><H1,8,0><I5>STATION<LF>
PRODUCT # <R43,3><H2,8,0><I5><R48,3><H2,8,0><I5><R53,3><H2,8,0><LF>
BATCH # <R43,3><H3,8,0><I5><R48,3><H3,8,0><I5><R53,3><H3,8,0><LF>
API TABLE: <R43,3><H4,8,0><I5><R48,3><H4,8,0><I5><R53,3><H4,8,0><LF>
AVG K FACTOR <R43,3><H5,8,2><I5><R48,3><H5,8,2><I5><R53,3><H5,8,2><LF>
AVG METER FACTOR <R43,3><H6,8,4><I5><R48,3><H6,8,4><I5><R53,3><H6,8,4><LF>
BATCH STARTED: <R43,3><H7,8,0><I5><R48,3><H7,8,0><I5><R53,3><H7,8,0><LF>
<R43,3><H8,8,0><I5><R48,3><H8,8,0><I5><R53,3><H8,8,0><LF>
<LF>
BATCH GROSS: <R43,3><H9,8,0,S1><I5><R48,3><H9,8,0,S1><I5><R53,3><H9,8,0,S1><I5><S1,8,0><LF>
BATCH NET: <R43,3><H10,8,0,S2><I5><R48,3><H10,8,0,S2><I5><R53,3><H10,8,0,S2><I5><S2,8,0><LF>
BATCH MASS: <R43,3><H11,8,0,S3><I5><R48,3><H11,8,0,S3><I5><R53,3><H11,8,0,S3><I5><S3,8,0><LF>
<LF>
DAILY GROSS: <R43,3><H12,8,0,S4><I5><R48,3><H12,8,0,S4><I5><R53,3><H12,8,0,S4><I5><S4,8,0><LF>
DAILY NET: <R43,3><H13,8,0,S5><I5><R48,3><H13,8,0,S5><I5><R53,3><H13,8,0,S5><I5><S5,8,0><LF>
DAILY MASS: <R43,3><H14,8,0,S6><I5><R48,3><H14,8,0,S6><I5><R53,3><H14,8,0,S6><I5><S6,8,0><LF>
<LF>
CUMM GROSS: <R43,3><H15,8,0,S7><I5><R48,3><H15,8,0,S7><I5><R53,3><H15,8,0,S7><I5><S7,8,0><LF>
CUMM NET: <R43,3><H16,8,0,S8><I5><R48,3><H16,8,0,S8><I5><R53,3><H16,8,0,S8><I5><S8,8,0><LF>
CUMM MASS: <R43,3><H17,8,0,S9><I5><R48,3><H17,8,0,S9><I5><R53,3><H17,8,0,S9><I5><S9,8,0><LF>
<LF>
DAILY AVERAGES:<LF>
TEMPERATURE DEG C: <R43,3><H18,8,2><I5><R48,3><H18,8,2><I5><R53,3><H18,8,2><LF>
PRESSURE BAR: <R43,3><H19,8,2><I5><R48,3><H19,8,2><I5><R53,3><H19,8,2><LF>
SG: <R43,3><H20,8,4><I5><R48,3><H20,8,4><I5><R53,3><H20,8,4><LF>
DENSITY@15 GM/CC: <R43,3><H21,8,4><I5><R48,3><H21,8,4><I5><R53,3><H21,8,4><LF>
DENSITY GM/CC: <R43,3><H22,8,4><I5><R48,3><H22,8,4><I5><R53,3><H22,8,4><LF>
VCF: <R43,3><H23,8,4><I5><R48,3><H23,8,4><I5><R53,3><H23,8,4><LF>
CPL: <R43,3><H24,8,4><I5><R48,3><H24,8,4><I5><R53,3><H24,8,4><LF>
CTPL: <R43,3><H25,8,5><I5><R48,3><H25,8,5><I5><R53,3><H25,8,4><LF>
<FF>
<X>
```

Figure 2. Daily Report Template

Example Daily Report - Formatted

AE Daily Report Upload.txt - Notepad

File Edit Format View Help

Thermo Fisher Scientific
Daily Report

Date/Time: 11/04/15 12:00:00

METER #	1111	2222	3333	STATION
PRODUCT #	1	2	3	
BATCH #	1	1	1	
API TABLE:	11	0	14	
AVG K FACTOR	500.00	500.00	500.00	
AVG METER FACTOR	1.0000	1.0000	1.0000	
BATCH STARTED:	110415	110415	110415	
	95822	95554	95554	
BATCH GROSS:	10034	24163	19770	53966
BATCH NET:	9969	25412	20584	55965
BATCH MASS:	2178	5553	7215	14946
DAILY GROSS:	10034	24163	19770	53966
DAILY NET:	9969	25412	20584	55965
DAILY MASS:	2178	5553	7215	14946
CUMM GROSS:	10034	24163	19770	53966
CUMM NET:	9969	25412	20584	55965
CUMM MASS:	2178	5553	7215	641324
DAILY AVERAGES:				
TEMPERATURE DEG C:	21.25	0.00	0.00	
PRESSURE BAR:	15.25	0.00	0.00	
SG:	0.6200	0.6563	0.6240	
DENSITY@15 GM/CC:	0.6240	0.6240	0.5987	
DENSITY GM/CC:	0.6194	0.6556	0.6234	
VCF:	0.9900	1.0517	1.0412	
CPL:	1.0036	1.0000	1.0000	
CTPL:	0.99356	1.05170	1.0412	
♀				

Figure 3. Daily Report Formatted

Example Prover Report - Template

```
Prove Report Template.txt - Notepad
File Edit Format View Help
<I20>Thermo Fisher Scientific<LF>
<I27>Prover Report<LF>
<EA><ZS>
Date/Time: <G1> <GT> API TABLE:<B0,51,1,6,20," 23/24A "," 23/24B "," 24C "," 23/24D "," 23/24E ","Old 23/24 "," 53/54A "," 53/54B "," 54C "," 53/54D "," 53/54E ","Old 53/54 ",
" CNP06/70 ","CNP06/70II","BR2alcohol","CH 11.3.3 "," API 2565 "," IUPAC "," SA/6A ">
METER # <P51,1,9,8,0><LF>
PRODUCT #: <B0,51,1,46,3,"1 CRUDE OIL","2 CRUDE OIL","3 CRUDE OIL"><LF>
PROVER DIAMETER INCH <P53,1,21,8,3> SERIAL NO: _____<LF>
PROVER WALL THK INCH <P53,1,22,8,4> MODEL NO: _____<LF>
ELASTICITY/STEEL <P53,1,23,8,0> LOCATION: _____<LF>
COEFF. CUBIC EXP <P53,1,24,8,7> <LF>
<I77,=><LF>
<LF>
PREVIOUS PROVE METER DATA<LF>
TEMPERATURE DEG C <P51,1,192,7,2> FLOWRATE <P51,1,185,8,2> FLOW TOTAL <P51,1,191,8,2><LF>
PRESSURE KG/CM2 <P51,1,188,7,2> METER FACTOR <P51,1,186,8,4> DATE <P51,1,171,8,2,DI> TIME <P51,1,172,8,2,T><LF>
<I77,=><LF>
Pass 1 Total Meter Press Prover Prover<LF>
Run Pulses Pulses Flowrate Temp Press Temp Press Gravity<LF>
<P51,1,191,9,0> <P51,1,192,8,0> <P51,1,193,8,0> <P51,1,197,8,2,Al> <P51,1,198,8,2> <P51,1,199,8,2> <P51,1,200,8,2> <P51,1,201,8,2> <P51,1,202,8,4><LF>
<P51,1,203,9,0> <P51,1,204,8,0> <P51,1,205,8,0> <P51,1,209,8,2,Al> <P51,1,210,8,2> <P51,1,211,8,2> <P51,1,212,8,2> <P51,1,213,8,2> <P51,1,214,8,4><LF>
<P51,1,215,9,0> <P51,1,216,8,0> <P51,1,217,8,0> <P51,1,221,8,2,Al> <P51,1,222,8,2> <P51,1,223,8,2> <P51,1,224,8,2> <P51,1,226,8,2> <P51,1,226,8,4><LF>
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A. PROVER VOLUME M3 <I48,-> <P53,1,20,8,5><LF>
B. PROVER TEMP. CORRECTION FACTOR (CTSP) <I27,-> <P51,1,312,8,6><LF>
C. PROVER PRES. CORRECTION FACTOR (CPSF) <I27,-> <P51,1,313,8,6><LF>
D. CORRECTION FACTOR FOR TEMP. OF THE LIQUID IN THE PROVER (CTLD) -- <P51,1,314,8,6><LF>
E. CORRECTION FACTOR FOR PRES. OF THE LIQUID IN THE PROVER (CPLP) -- <P51,1,315,8,6><LF>
F. CORRECTED VOLUME OF THE LIQUID IN THE PROVER <I20,-> <P51,1,316,8,5><LF>
G. TOTAL AVERAGE METER PULSES COUNTED <I30,-> <P51,1,317,8,2><LF>
H. K FACTOR PULSE/M3 <I47,-> <P51,1,319,8,3><LF>
I. GROSS METER VOLUME <I46,-> <P51,1,320,8,5><LF>
J. CORRECTION FACTOR FOR TEMP. OF THE LIQUID IN THE METER (CTIM) --- <P51,1,321,8,6><LF>
K. CORRECTION FACTOR FOR PRES. OF THE LIQUID IN THE METER (CPIM) --- <P51,1,322,8,6><LF>
L. CORRECTED METER VOLUME (I*J*K) M3 <I31,-> <P51,1,190,8,5><LF>
M. METER FACTOR (F/L) <I46,-> <P51,1,323,8,5> <LF>
N. PULSE COUNT REPEATABILITY % <I37,-> <P51,1,486,8,6><LF>
O. CURRENTLY USED METER FACTOR <I37,-> <P51,1,16,8,5><LF>
P. DEVIATION FROM PREVIOUS METER FACTOR 100*(M-O)/O = <P51,1,497,4,2>*<LF>
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ADDITIONAL COMMENTS:<LF>
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WITNESSED BY <I24,=><I3>WITNESSED BY <I24,=><LF>
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FOR <I33,=><I3>FOR <I33,=><LF>
<FF>
<X>
4
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Figure 4. Prover Report Template

Example Prover Report - Formatted

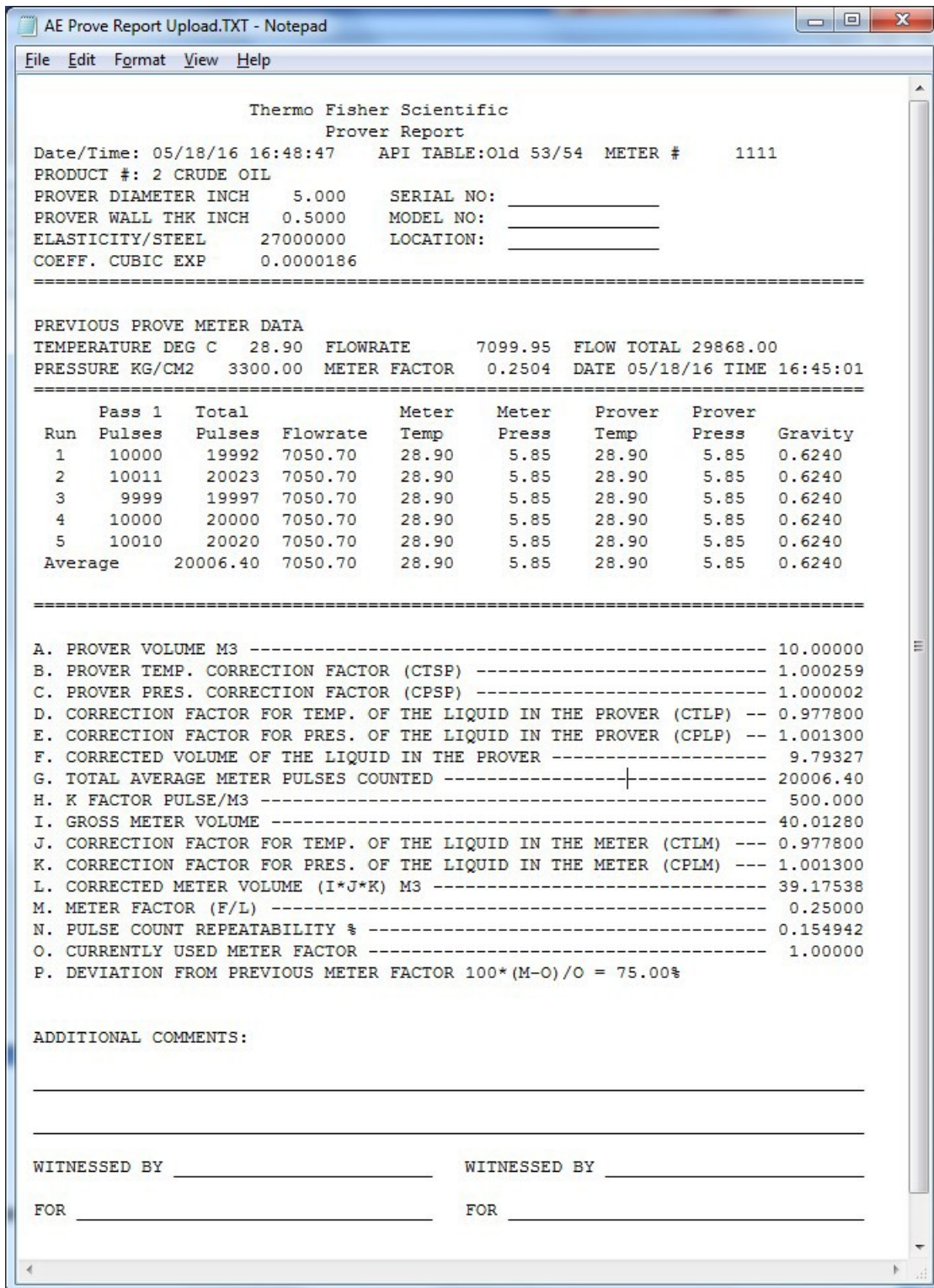


Figure 5. Prover Report Formatted

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