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TABLES

SECTION 4: EVENT REPORTING

EVENT REPORT GENERATION

The relay generates event reports in response to the actions listed in Table 4.1. Four different event report formats are available. Which event report format you select to review depends upon the amount of data resolution you require. These formats are:

- Summary Quick review of critical fault information for operations personnel
- Default 1/4-cycle data resolution for quick review of routine relay operations
- Long 1/16-cycle data resolution for detailed review
- Computer Use with the SEL-5601 program for detailed review and oscillograph plotting

All summary event reports are automatically sent to all communications ports designated as AUTO in the relay setting communications port settings. The relay can store up to twelve event reports (see ***EVENT Command*** in ***Section 3: Communications*** for more details.)

Table 4.1: Event Report Triggering Actions

- Any tripping element assertions (**TPA**, **TPB**, **TPC**, or **3PT**)
- TRIGGER command execution
- Assertion of any element in the MER (mask for event report trigger) logic variable
- External Trigger input assertions

For event reports triggered by **TPA**, **TPB**, **TPC**, or **3PT** assertion, the TYPE designation is appended with a "T." This makes it easy to distinguish between event reports that involve a trip and those which do not.

Table 4.2 lists relay elements which must assert for the relay to record a fault type and fault location in the event report. If none of these elements assert and any action listed in Table 4.1 is true, the relay generates an event report but does not list a fault type or calculate a fault location.

Table 4.2: Event Report Fault Type and Fault Location Enabling Elements

Fault Type	Elements				
Phase-phase or three-phase	M1P	M2P	M3P	M4P	
Single-Line-Ground	Z1G 67N1	Z2G 67N2	Z3G 67N3	Z4G 67N4	51NP

Event records taken with no triggering relay elements have the type shown in Table 4.3.

Table 4.3: Event Record Type

Type	Comment
TRIP	Report triggered by TPA, TPB, TPC, or 3PT assertion, no fault.
EXT	Report triggered by assertion of EXT (external trigger) designated input.
EXTC	Report triggered by TRIGGER command.
ER	Report triggered by MER SELOGIC® control equations, but no fault detecting element asserted at trigger instant.

The MER mask triggers event reports on the rising-edge of the first element in the mask. The relay does not generate multiple event reports when additional relay elements within MER pick up; only the first relay element of any continuous sequence triggers an event report.

Tripping and External Trigger events are rising-edge sensitive. For these events, event reports are generated independent of the state of MER. The relay triggers a second report for the same event if **TPA, TPB, TPC,** or **3PT** asserts. Thus, the relay records the beginning and end of each event. A second event report is not provided, however, if **TPA**, **TPB**, **TPC,** or **3PT** first assert at or less than seven cycles after the first report is triggered.

Event report triggering and time stamping is referenced to the 16th quarter-cycle of data with 1/8-cycle resolution.

SUMMARY EVENT REPORT

The summary report is automatically transmitted to port(s) designated AUTO regardless of access level. The summary event report includes:

- Line terminal identifier (set in the relay setting procedure)
- Date and time
- Event type (see Table 4.4) and fault location
- System frequency at the time of the trip (this is 1/16th of the sampling frequency at the time of the trip)
- Front panel relay targets asserted at the last row of the event report
- The magnitude and angle of positive-sequence polarizing voltage memory at the time of trigger

Table 4.4: Event Types

Event Type	Comment
AG	A-Phase to Ground Fault
BG	B-Phase to Ground Fault
CG	C-Phase to Ground Fault
AB	AB Two-Phase Fault
BC	BC Two-Phase Fault
CA	CA Two-Phase Fault
ABG	AB Two-Phase to Ground Fault
BCG	BC Two-Phase to Ground Fault
CAG	CA Two-Phase to Ground Fault
ABC	Three-Phase Faults

The following shows an example summary event report:

```
Example: BUS B, BREAKER 3              Date: 08/21/00    Time: 01:36:50.070
Event:  AG T    Location:  2.43      Frequency:    60.2
Targets:  INST ZONE 1 EN AG         V1 Mem: 131.2/77
=>
```

The relay retains the summary event report buffer when control power is removed. Long event report data is cleared when control power is removed.

DEFAULT EVENT REPORT

Generate the default event report using the EVENT x command, with no format specifier. These reports default to 11-cycle duration, four samples/cycle, and resemble the reports from the SEL-100/200 series relays. Each report contains voltages, currents, factory selected relay elements, inputs and outputs. These reports support analysis of most relay operations. The default report analog data are sampled every 1/16-cycle, but display every quarter-cycle. Binary elements (relay elements, contact inputs, and contact outputs) are displayed as follows:

- If an element is set at any time during a quarter-cycle period, it is displayed as set; otherwise, it is cleared. Given that elements A and B pick up in alternate 1/8-cycles, but not simultaneously, and assuming that element C = A*B, the filtered report would show A and B true, but C false, because A and B were not picked up at the same time.

LONG EVENT REPORT

The long event report is output in response to the EVENT x L command. The Header, Summary and Settings sections of the long report are identical to the default report. The event report body differs as follows:

The "L" format option increases the event report resolution to 16 samples/cycle. The bodies of the 4 and 16 samples/cycle reports differ as follows:

- The 16 samples/cycle report has four times as many data rows (total of 11 cycles · 16 rows/cycle = 176 rows).
- The element and contact input and output columns are sampled every 1/8-cycle, and displayed in 1/16-cycle format. If an element asserts for 1/8-cycle, it would indicate assertion for two rows in the long event report.

COMPUTER EVENT REPORT

Generate the computer event report using the EVENT x C command. This format provides complete relay element data by attaching a hexadecimal representation of the relay elements on a per processing interval basis. This report is an 11-cycle duration, 16 samples/cycle report. All inputs, outputs, and relay elements are shown in the computer event report.

UNFILTERED EVENT REPORT

Generate the unfiltered event report using the **EVENT x U** command. These reports are identical to the EVE C event report, except that the analog data are not digitally filtered. Use the unfiltered event report in computer analysis of data.

MIRRORED BITS™ DISPLAY EVENT REPORT

Generate an event report where TMB1...TMB8 replaces OUT1...OUT8 and RMB1...RMB8 replaces IN1...IN8 by appending any of the event report commands listed above with a space M. With the exception of the display of the first eight inputs and outputs, the remainder of the M form of the event report is identical.

SEQUENTIAL EVENTS RECORDER (SER) REPORT

See the example Sequential Event Recorder (SER) report later in this section.

SER Triggering

The relay triggers (generates) an entry in the SER report for a change of state of any one of the elements listed in the SER1, SER2, and SER3 trigger settings. The factory default settings are:

SER1 = IN1 IN2 IN3

SER2 = 51PT 51QT M1P Z1G 51NT

SER3 = OUT1

The elements are Relay Word bits referenced in Table 2.6 – 2.21. The relay monitors each element in the SER lists every 1/8 cycle. If an element changes state, the relay time-tags the changes in the SER. For example, setting SER2 contains:

time-overcurrent elements(51PT, 51QT, and 51NT)

distance elements(M1P and Z1G)

Thus, any time one of these overcurrent or distance elements picks up or drops out, the relay time-tags the change in the SER.

The other two SER factory settings (SER1 and SER3) trigger rows in the SER event report for such things as optoisolated input (IN1, IN2, or IN3), and output contact (OUT1).

The relay adds the message "Relay newly powered up" to the SER to indicate power up and the message "Relay settings changed" to indicate a settings change (to active setting group).

Each entry in the SER includes SER row number, date, time, element name, and element state.

Making SER Trigger Settings

Enter up to 24 element names in each of the SER settings via the **SET R** command. See Table 2.6 - Table 2.21 for references to valid element (Relay Word bit) names. See the SET R command in Table 3.5 and the relay command summary at the end of ***Section 3***. Use either spaces or commas to delimit the elements. For example, if you enter setting SER2 as:

SER2 = 51PT,51QT M1P,,Z1G , 51NT

The relay displays the setting as:

SER2 = 51PT 51QT M1P Z1G 51NT

The relay can monitor up to 72 elements in the SER (24 in each of SER1, SER2, and SER3).

Retrieving SER Reports

The relay saves the latest 256 rows of the SER in volatile memory. Row 1 is the most recently triggered row, and row 256 is the oldest. View the SER report by SER row number as outlined in the example below.

Example SER Serial Port Commands	Format
SER	If SER entered with no numbers following it, all available rows are displayed (up to row number 256). They display with the oldest row at the beginning (top) of the report and the latest row (row 1) at the end (bottom) of the report.
SER 17	If SER is entered with a single mumber following it(17 in this example), The display will start at row 17(if it exists) first, and latest row at the end (bottom) of the report.
SER 10 33	If SER is entered with two numbers following it (10 and 33 in this example; 10 < 33), all the rows between (and including) rows 10 and 33 are displayed, if they exist. They display with the oldest row (row 33) at the beginning (top) of the report and the latest row (row 10) at the end (bottom) of the report.

If the requested SER event report rows do not exist, the relay responds:

No SER Data

Clearing SER Report

If you want to clear old SER report and start to record new SER event report, you can use **SER C** command to clear the SER report as:

```
=>SER C <ENTER>
Clear the SER
Are you sure (Y/N) ? Y <ENTER>
Clearing Complete
```

INTERPRETATION OF QUARTER-CYCLE VOLTAGE AND CURRENT DATA

The relay uses secondary quantities presented to the input terminals of the relay. One line of data is displayed for each quarter-cycle. Voltages and currents are shown in primary quantities. The value in each column of the default event report is calculated and scaled as follows:

I_R Calculated I_R value, multiplied by CTR from group active at time of trigger.

I_A, I_B, I_C Sampled, filtered value, multiplied by CTR from group active at time of trigger.

V_A, V_B, V_C Sampled, filtered value, multiplied by PTR from group active at time of trigger.

Analog data are filtered by an analog low-pass filter with a cutoff frequency of 540 Hz. A digital filter processes the sampled data and removes dc and ramp components. The digital filter is a full cycle long, cosine filter centered on the sensed frequency.

Successive lines of the event report occur every 90°. With respect to the present value, the previous value was taken one quarter-cycle earlier and appears to be leading the present value by 90°.

Quarter-cycle event report values can be used to represent the signals as phasors:

The previous value of the output is the Y-component.

The present value of the output is the X-component.

It may seem confusing to refer to the older data as the leading component of the phasor. The following example may help.

Consider a sine wave having zero phase shift with respect to t = 0 and a peak amplitude of 1. Now consider two samples, one taken at t = 0, the other taken 90° later. They have values 0 and 1, respectively. By the above rules, the phasor components are (X,Y) = (1,0).

Now consider a cosine function. Its samples taken at t = 0 and t+90° are 1 and 0; its phasor representation is (0,1). The phasor (0,1) leads the phasor (1,0) by 90°. This coincides with a 90° lead of the cosine function over the sine function.

To construct a phasor diagram of voltages and currents, select a pair of adjacent rows from an area of interest in the quarter-cycle event report. On Cartesian coordinates, plot the lower row (newer data) as the X-components and the upper row (older data) as the Y-components. Rotate the completed diagram to any angle of reference. The magnitude of any phasor equals the square root of the sum of its squares.

Note that moving forward one quarter-cycle rotates all phasors 90°. You can verify this by plotting the phasor diagram with rows 1 and 2, then rows 2 and 3 of an event report. Example Event 1 shows the process of converting the rectangular format voltages and currents displayed in the event report to polar format.

RELAY ELEMENT COLUMNS DATA

The states of all relay elements are indicated in the columns headed "Relay Elements." Active states of the various relay elements are indicated by designator symbols which correspond with the relay element names. The contents of the columns for active relay elements appear as follows.

Column	Value	Description
ZAB	.	If no AB phase-phase distance element set
	1	If Zone 1 AB phase-phase distance element (**MAB1**) set
	2	If Zone 2 AB phase-phase distance element (**MAB2**) set, not ZAB1
	3	If Zone 3 AB phase-phase distance element (**MAB3**) set, not ZAB1 | ZAB2
	4	If Zone 4 AB phase-phase distance element (**MAB4**) set, not ZAB1 | ZAB2 | ZAB3
ZBC	.	If no BC phase-phase distance element set
	1	If Zone 1 BC phase-phase distance element (**MBC1**) set
	2	If Zone 2 BC phase-phase distance element (**MBC2**) set, not ZBC1
	3	If Zone 3 BC phase-phase distance element (**MBC3**) set, not ZBC1 | ZBC2
	4	If Zone 4 BC phase-phase distance element (**MBC4**) set, not ZBC1 | ZBC2 | ZBC3

Column	Value	Description
ZCA	.	If no CA phase-phase distance element set
	1	If Zone 1 CA phase-phase distance element (**MCA1**) set
	2	If Zone 2 CA phase-phase distance element (**MCA2**) set, not ZCA1
	3	If Zone 3 CA phase-phase distance element (**MCA3**) set, not ZCA1 | ZCA2
	4	If Zone 4 CA phase-phase distance element (**MCA4**) set, not ZCA1 | ZCA2 | ZCA3
ZAG	.	If no AG mho or quadrilateral ground distance element asserted
	1	If Zone 1 AG element (**XAG1** + **MAG1**) set
	2	If Zone 2 AG element (**XAG2** + **MAG2**) set, not ZAG1
	3	If Zone 3 AG element (**XAG3** + **MAG3**) set, not ZAG1 | ZAG2
	4	If Zone 4 AG element (**XAG4** + **MAG4**) set, not ZAG1 | ZAG2 | ZAG3
ZBG	.	If no BG mho or quadrilateral ground distance element asserted
	1	If Zone 1 BG element (**XBG1** + **MBG1**) set
	2	If Zone 2 BG element (**XBG2** + **MBG2**) set, not ZBG1
	3	If Zone 3 BG element (**XBG3** + **MBG3**) set, not ZBG1 | ZBG2
	4	If Zone 4 BG element (**XBG4** + **MBG4**) set, not ZBG1 | ZBG2 | ZBG3
ZCG	.	If no CG mho or quadrilateral ground distance element asserted
	1	If Zone 1 CG element (**XCG1** + **MCG1**) set
	2	If Zone 2 CG element (**XCG2** + **MCG2**) set, not ZCG1
	3	If Zone 3 CG element (**XCG3** + **MCG3**) set, not ZCG1 | ZCG2
	4	If Zone 4 CG element (**XCG4** + **MCG4**) set, not ZCG1 | ZCG2 | ZCG3
OOS	t	OOS timing
	B	OOS Block (**OSB * !OST**)
	T	OOS Trip (OST)
32		Negative-sequence directional element decision. There are two negative-sequence directional elements. Both directional elements cannot be asserted at the same time. The following labeling system is used in the 32 column:
	Q	forward (**32QF**)
	q	reverse (**32QR**)
	.	none
51N	.	No 51N condition (!51NT * !51NP)
	p	51N timing (51NP * !51NT)
	T	51N tripped (51NT)
51Q	.	No 51Q condition (!51QP * !51QT)
	p	51Q timing (51QP * !51QT)
	T	51Q tripped (51QT)

Column	Value	Description
51P	.	No 51P condition (!51PP * !51PT)
	p	51P timing (51PP * !51PT)
	T	51P tripped (51PT)
50P	.	No 50P condition (!50L * !50M * !50H)
	L	Low-set overcurrent (50L * !50M * !50H)
	M	Medium-set overcurrent (50M * !50H)
	H	High-set overcurrent (50H)
67N	.	No 67N elements set (!67N1 * !67N2 * !67N3 * !67N4)
	1	Zone 1 67N (67N1)
	2	Zone 2 67N (!67N1 * 67N2)
	3	Zone 3 67N (!67N1 * !67N2 * 67N3)
	4	Zone 4 67N (!67N1 * !67N2 * !67N3 * 67N4)
67Q	.	No 67Q elements set (!67Q1 * !67Q2 * !67Q3 * !67Q4)
	1	Zone 1 67Q (67Q1)
	2	Zone 2 67Q (!67Q1 * 67Q2)
	3	Zone 3 67Q (!67Q1 * !67Q2 * 67Q3)
	4	Zone 4 67Q (!67Q1 * !67Q2 * !67Q3 * 67Q4)
LOP	.	No LOP condition (!LOP)
	*	LOP condition (LOP)

CONTACT INPUTS AND OUTPUTS COLUMNS

The columns headed "Outputs" and "Inputs" show the states of the first eight outputs and the first eight inputs. (These are either the physical outputs and inputs or the mirrored-bit outputs and inputs. The EVE 1 L M shows the long form of the event report with TMB1...TMB8 and RMB1...RMB8 occupying the last columns of the event report.)

Since there are only four columns under each heading, the outputs and inputs are paired in groups of two. If an output is asserted in the first column, a "1" or "2" appears in the column to indicate which output is asserted. If both inputs are asserted, a "B" would appear under the associated column. A period indicates deassertion. All outputs and inputs are assignable. The most important output functions should be assigned to the first eight outputs since they are the only outputs displayed in the standard event report. Functions assigned to outputs above eight are not displayed on the event report but are available in the computer event report format. The following list shows the contents of these columns.

Outputs	Inputs
1 & 2 : Output 1 and Output 2	1 & 2 : Input 1 and Input 2
3 & 4 : Output 3 and Output 4	3 & 4 : Input 3 and Input 4
5 & 6 : Output 5 and Output 6	5 & 6 : Input 5 and Input 6
7 & 8 : Output 7 and Output 8	7 & 8 : Input 7 and Input 8

EXAMPLE EVENT REPORTS

Example Event Report 1

```
Example:  BUS B, BREAKER 3                Date: 08/21/00   Time: 08:54:29.577
FID=SEL-321-3-R400-V656112pb-Z000000-D20010213
     CURRENTS (pri)             VOLTAGES (kV pri)    RELAY  ELEMENTS  OUT  IN
                                                    ZZZZZZO  555566L 1357 1357
                                                    ABCABCO 3111077O &&&& &&&&
   IR      IA     IB     IC     VA      VB      VC  BCAGGGS 2NQPPNQP 2468 2468

    -4   -447    320    123   -129.3   89.1    40.7 ....... ........ .... ....
    -2   -112   -328    438    -27.8  -98.5   125.8 ....... ........ .... ....
     3    447   -320   -124    129.3  -89.1   -40.7 ....... ........ .... ....
    -1    111    327   -439     27.8   98.4  -125.8 ....... ........ .... ....
```

One cycle of data (Quarter-cycle event report)

SEL DIRECTION AND POLARITY CHECK FORM

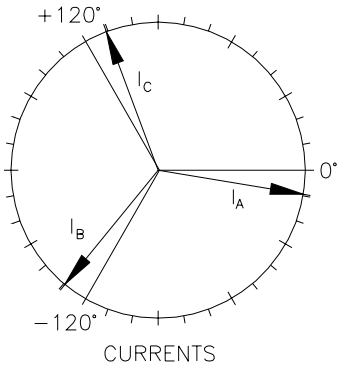
STATION Example 230 kV Line DATE: 02/01/93 TESTED BY _____
SWITCH NO. _____ EQUIPMENT SEL-321
INSTALLATION _____ ROUTINE _____ OTHER X

LOAD CONDITIONS:

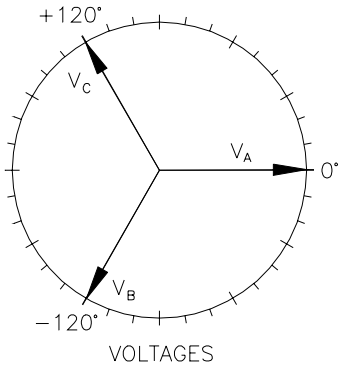
STATION READINGS: _____ MW (OUT)(IN) _____ MVAR (OUT)(IN) _____ VOLTS _____ AMPS
SEL READINGS: _____ MW (⊕)(−) _____ MVAR (⊕)(−)

AS SEEN ON SCREEN	Ia	Ib	Ic	Va	Vb	Vc	
COMPANY NOTATION	I(a)	I(b)	I(c)	V(a)	V(b)	V(c)	
1st LINE CHOSEN (Y COMPONENT)	−447	320	123	−129.3	89.1	40.7	
2nd LINE CHOSEN (X COMPONENT)	−112	−328	438	−27.8	−98.5	125.8	
CALCULATED MAGNITUDE $\sqrt{X^2+Y^2}$	460.8	458.2	454.9	132.3	132.8	132.2	ROW 1
ANGLE IN DEGREES ARCTAN Y/X	−104.1	135.7	15.7	−102.1	137.9	17.9	
VALUE OF Va DEGREES TO SUBTRACT TO OBTAIN Va DEGREES = 0	+102.1	+102.1	+102.1	+102.1	+102.1	+102.1	
@ Va DEGREES = 0, ANGLE USED TO DRAW PHASOR DIAGRAM	−2.0	−122.2	117.8	0	−120.0	+120.0	ROW 2

USE THE VALUES IN ROWS 1 AND 2 ABOVE TO DRAW PHASOR DIAGRAMS BELOW



CURRENTS



VOLTAGES

DWG: A7-0446X

Example Event Report 2

```
BUS B, BREAKER 3                        Date: 08/21/00    Time: 08:54:29.577

FID=SEL-321-3-R400-V656112pb-Z000000-D20010213
    CURRENTS (pri)            VOLTAGES (kV pri)     RELAY ELEMENTS  OUT   IN
                                                   ZZZZZZO  555566L 1357 1357
                                                   ABCABCO 31110770 &&&& &&&&
   IR     IA     IB     IC     VA      VB      VC   BCAGGGS 2NQPPNQP 2468 2468

    -4   -447    320    123  -129.3    89.1    40.7 ....... ....L... .... 1...
    -2   -112   -328    438   -27.8   -98.5   125.8 ....... ....L... .... 1...
     3    447   -320   -124   129.3   -89.1   -40.7 ....... ....L... .... 1...
    -1    111    327   -439    27.8    98.4  -125.8 ....... ....L... .... 1...

    -6   -448    319    123  -129.3    89.1    40.7 ....... ....L... .... 1...
    -3   -113   -328    438   -27.8   -98.4   125.8 ....... ....L... .... 1...
     3    447   -320   -124   129.3   -89.1   -40.7 ....... ....L... .... 1...
     0    112    327   -439    27.8    98.4  -125.8 ....... ....L... .... 1...

    -5   -447    319    123  -129.3    89.1    40.7 ....... ....L... .... 1...
    -3   -113   -328    438   -27.8   -98.4   125.8 ....... ....L... .... 1...
     2    446   -320   -124   129.3   -89.1   -40.7 ....... ....L... .... 1...
     0    112    327   -439    27.8    98.4  -125.8 ....... ....L... .... 1...

    -6   -448    319    123  -129.3    89.1    40.6 ....... ....L... .... 1...
    -2   -112   -328    438   -27.9   -98.4   125.8 ....... ....L... .... 1...
  -582   -138   -320   -124   118.9   -93.4   -44.8 ....... ....L... .... 1...
  1345   1457    327   -439    21.3    95.3  -129.0 ....... Qpp.M... .... 1...

   810    368    319    123   -93.4   104.0    55.3 ....... Qpp.M... .... 1...
 -3301  -3411   -328    438   -14.7   -92.1   132.2 ...1... Qpp.H... B4.. 1...
  -459    -15   -320   -124    78.4  -110.4   -61.6 ...1... Qpp.H... B4.. 1...
  3905   4017    327   -439    14.7    92.0  -132.2 ...1... Qpp.H... B4.. 1...

   456     14    319    123   -78.4   110.4    61.6 ...1... Qpp.H... B4.. 1...
 -3907  -4017   -328    438   -14.7   -92.0   132.2 ...1... Qpp.H... B4.. 1. ..
  -460    -15   -321   -124    78.3  -110.5   -61.6 ...1... Qpp.H... B4.. 1...
  3904   4016    327   -439    14.7    92.0  -132.3 ...1... Qpp.H... B4.. 1...

   459     16    320    123   -78.3   110.4    61.6 ...1... Qpp.H... B4.. 1...
 -3907  -4017   -328    438   -14.8   -92.0   132.3 ...1... Qpp.H... B4.. 1...
   126    479   -206   -147    80.1  -108.5   -46.7 ...1... Qpp.H... B4.. 1...
  2555   2610    228   -283    35.0    82.3  -129.8 ...1... Qpp.H... B4.. 1...

  -359   -489     45     85   -98.0   111.4    15.1 ...1... Qpp.H... B4.. 1...
  -604   -602    -65     63   -61.5   -69.0   130.1 ...1... Qpp.M... B4.. ....
     0      1     -1      0   114.2  -116.3     1.5 ....... Qpp.M... B... ....
    -2     -1     -1      0    67.8    65.3  -132.8 ....... .pp..... B... ....

    -2     -2      0      0  -114.2   116.4    -1.5 ....... ........ B... ....
    -1      0      0     -1   -67.8   -65.2   132.8 ....... ........ B... ....
     1      2     -1      0   114.2  -116.4     1.5 ....... ........ B... ....
    -1     -1      0      0    67.8    65.2  -132.8 ....... ........ B... ....

    -4     -3      0     -1  -114.2   116.4    -1.6 ....... ........ B... ....
     0      1      0     -1   -67.9   -65.2   132.8 ....... ........ B... ....
     2      2      0      0   114.2  -116.4     1.6 ....... ........ B... ....
    -3     -2     -1      0    67.8    65.2  -132.8 ....... ........ B... ....

    -2     -2      0      0  -114.2   116.4    -1.6 ....... ........ B... ....
     0      1      0     -1   -67.9   -65.2   132.8 ....... ........ B... ....
    -1      1     -1     -1   114.2  -116.4     1.6 ....... ........ B... ....
    -3     -2     -1      0    67.9    65.2  -132.8 ....... ........ B... ....

Event:  AG    Location:  +14.92    Frequency:    60.0

Targets: INST ZONE1 EN A G          V1 Mem:   132.1 /  77
```

Date and time-tag correspond to the 16th quarter-cycle of this event

Firmware Identification Code

One cycle of data

Input 1 (1) is energized

50L element asserted

32QF element asserts
51N element asserts, event trigger
51Q element asserts, event trigger
50M element asserts

Zone 1, A-phase ground distance asserted

50H element asserted

KEY bit asserted

Both OUT1 and OUT2 outputs asserted by 3PT bit

A-phase ground fault at 14.92, system frequency is 60 Hz

Front panel targets, V1 memory mag [kV] and angle referenced to A-phase at the trigger instant

Example Event Report 2 (continued)

```
GROUP 1 ———————————————————————————————— Setting Group 1 was active during this event
RELID =SEL-321 POTT
TRMID =BUS B, BREAKER 3
Z1MAG = 7.80    Z1ANG = 83.97   Z0MAG = 24.79   Z0ANG = 81.46
LOCAT = Y       LL    = 100.00  CTR   = 200.0   PTR   = 2000.0
PMHOZ = 3       GMHOZ = 3       QUADZ = 3
DIR1  = F       DIR2  = F       DIR3  = R       DIR4  = F
Z1P   = 6.24    Z2P   = 9.36    Z3P   = 1.87
50PP1 = 2.55    50PP2 = 2.22    50PP3 = 2.45
Z1MG  = 6.24    Z2MG  = 9.36    Z3MG  = 1.87
XG1   = 6.24    XG2   = 9.36    XG3   = 1.87
RG1   = 2.50    RG2   = 5.00    RG3   = 6.00
50L1  = 0.90    50L2  = 0.90    50L3  = 1.30
50G1  = 0.90    50G2  = 0.60    50G3  = 0.50
k01M  = 0.726   k01A  =-3.69    k0M   = 0.726   k0A   =-3.69    T     = 0.00
EOOS  = N
ELE   = Y       ZLF   = 9.22    ZLR   = 9.22
PLAF  = 30      NLAF  =-30      PLAR  = 150     NLAR  = 210
Z2F   = 0.77    50QF  = 0.5     Z2R   = 5.45    50QR  = 0.5     a2    = 0.07
E51P  = N
E51N  = Y       51NP  = 0.74    51NC  = U3
51NTD = 2.00    51NRS = Y       51NTC = 32QF
E50N  = N
E51Q  = Y       51QP  = 2.20    51QC  = U3
51QTD = 2.00    51QRS = N       51QTC = 32QF
E50Q  = N
EVOLT = N
Z2PD  = 20.00   Z3PD  = 0.00
Z2GD  = 20.00   Z3GD  = 0.00
EPOTT = Y       Z3RBD = 5.00    EBLKD = 10.00
ETDPU = 2.00    EDURD = 4.00
EDCUB = N
EZ1EXT= N
EREJO = N
ESOTF = Y       ENCLO = Y       CLOEND= 10.00   EN52A = N
SOTFD = 30.00   50H   = 11.25
ELOP  = Y       LOPD  = 3.00    50M   = 2.37    59QL  = 14.00   59PL  = 14.00
EPOLD = N       ESPT  = N       ESPO  = N
3POD  = 1.50    ESTUB = Y       50MFD = 20.00   TULO  = 3
TDURD = 9.00    TOPD  = 0.00    TXPU  = 0.00    TXDO  = 0.00
TYPU  = 0.00    TYDO  = 0.00    TZPU  = 0.00    TZDO  = 0.00    ITTD  = 5.00

SELogic group 1 ———————————————————————— SELOGIC control equations for Group 1

V     =NA
W     =NA
X     =NA
Y     =NA
Z     =NA
MTCS  =M2P + Z2G
MTU   =M1P + Z1G + M2PT + Z2GT + 51NT + 51QT + 50MF
MTO   =M1P + M2P + Z1G + Z2G + 50H
MER   =M2P + Z2G + 51NP + 51QP + 50H + LOP*52AA1
OUT1  =3PT
OUT2  =3PT
OUT3  =CC
OUT4  =KEY
OUT5  =NA
OUT6  =NA
OUT7  =NA
OUT8  =NA
OUT9  =NA
OUT10 =NA
OUT11 =NA
OUT12 =NA
OUT13 =NA
OUT14 =NA
OUT15 =NA

IN1   = 52A1    IN2   = PT      IN3   = CLOSE   IN4   = NA
IN5   = NA      IN6   = NA      IN7   = NA      IN8   = PTXFR
FP TIMEOUT= 5       TGR   = 5                                  ——— Global Settings
```

EXAMPLE SEQUENTIAL EVENTS RECORDER (SER) REPORT

```
=>>SER <ENTER>


EXAMPLE: BUS B, BREAKER 3              Date: 08/28/00    Time: 08:02:11.998
FID=SEL-321-3-R400-V656112pb-Z000000-D20010213

#     DATE      TIME           ELEMENT            STATE

15    08/18/00  00:00:01.286    Relay newly powered up
14    08/20/00  00:01:30.401   IN1                Asserted
13    08/20/00  00:01:30.442   IN1                Deasserted
12    08/22/00  00:10:49.870    Relay settings changed
11    08/22/00  00:13:59.728   IN1                Asserted
10    08/28/00  00:10:59.728   Z1G                Asserted
9     08/28/00  00:10:59.730   M1P                Asserted
8     08/28/00  00:10:59.748   OUT1               Asserted
7     08/28/00  00:10:59.836   51QT               Asserted
6     08/28/00  00:11:00.228   IN1                Deasserted
5     08/28/00  00:11:00.228   Z1G                Deasserted
4     08/28/00  00:11:00.228   M1P                Deasserted
3     08/28/00  00:11:00.240   51QT               Deasserted
2     08/28/00  00:11:00.245   OUT1               Deasserted
1     08/28/00  00:11:02.736   IN1                Asserted

=>>
```

FIRMWARE IDENTIFICATION

The SEL-321-3 Relay provides a means of interpreting Firmware Identification Data (FID). The FID string is included near the top of each long event report. The string format is as follows:

FID = [PN] – R[RN] – V[VS] – Z[ES] – D[RD]

Where:

[PN] = Product Name (e.g., SEL-321-3)

[RN] = Revision Number (e.g., 400)

[VS] = Version Specifications (e.g., 656112pb)

[ES] = External Software Version (e.g., 003002). The first three digits (003) represent the Settings Version Number. The last three digits (002) represent the Protocol Version Number.

[RD] = Release Date (e.g., YYYYMMDD = 20010213)

For the SEL-321-3 Relay, version specifications are interpreted as follows:

V[VS] = V[ABCDEFGH]

Option	Specifier	Specifier Meaning	Option Description
A	5, 6	50 Hz, 60 Hz	Power System Frequency
B	1, 5	1 A, 5 A	Nominal A per Phase
C	6	67 volts	Nominal Volts per Phase
D	1	Standard 300	Front Panel Type
E	1, 2	1 bank, 2 banks	Number of Banks of Digital Inputs
F	2, 4	2 banks, 4 banks	Number of Banks of Contact Outputs
G	p, n	abc, acb	Phase Rotation Sequence
H			Main Board Version Level

Please contact Schweitzer Engineering Laboratories for more information concerning available versions of the relay (see ***Factory Assistance*** in ***Section 7: Maintenance and Testing***). Version specifications provided above are not intended for ordering purposes but to help users identify software installed in a relay.