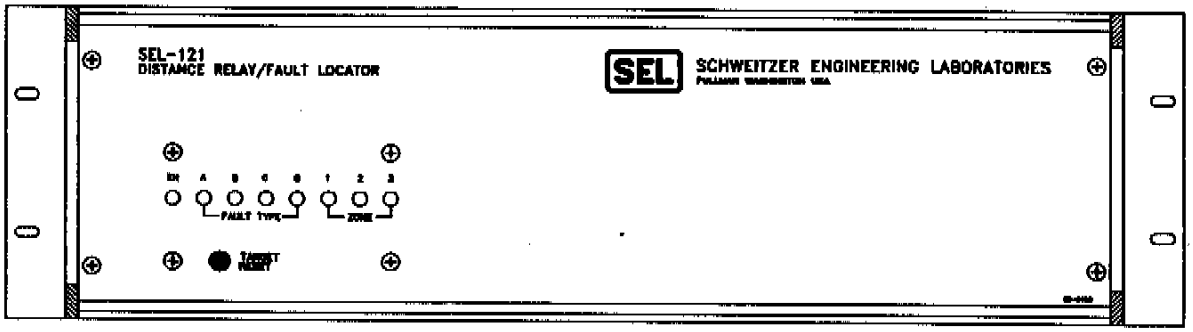
SCHWEITZER ENGINEERING LABORATORIES, INC.
Making Electric Power Safer, More Reliable, and More Economical



SEL-121
DISTANCE RELAY
AND FAULT LOCATOR

DATA SHEET

- Three-Zone Distance Relaying with Single-Pole Tripping
- Automatic Reclosing for Unbalanced Zone 1 and Transfer-Tripped Faults
- Communications Ports for Local and Remote Access
- Fault Locating
- Targets
- Economical
- Event Reporting
- Metering
- Reliable
- Automatic Self Testing
- Time Code Synchronization
- Compact

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GENERAL DESCRIPTION

The SEL-121 DISTANCE RELAY/FAULT LOCATOR performs protective relaying, fault locating, and many other unique functions.

Features include:

- **Three-Zone Distance Relaying with Single-Pole Outputs**
- **Automatic Reclosing**
- **Transmission Line Fault Locating**
- **Event Recording**
- **Automatic Self Testing**
- **Metering**
- **Target Indicators for Faults and Testing**
- **Time Code Input**
- **Communications Ports for Local and Remote Access**
- Compact Size

Protection features and economy make the SEL-121 relay ideal for application at most transmission voltages.

The economy of the SEL-121 relay is enhanced by its many unique features.

As a protective relay, the SEL-121 provides three zones of mho-circle directional distance protection over a very wide range of impedance settings. The SEL-121 relay trips single pole for all single-line-to-ground faults in Zone 1 or those cleared by transfer tripping. It trips three-pole for all other faults it covers. Two three-pole output contacts and three single-pole outputs make the SEL-121 relay ideal for both single-pole and three-pole applications. The SEL-121 relay automatically recloses the circuit breaker for all unbalanced faults in Zone 1 or cleared by transfer tripping. The operating time of the SEL-121 relay is about one cycle, making it much faster than switched schemes, and about the same as unswitched polyphase relays.

Faults and other conditions trigger event recordings, which are eleven cycles long. For faults, the SEL-121 relay uses the data to automatically compute and report fault location. The Takagi algorithm it uses is very tolerant of fault resistance and load flow, offering a ten-to-one error reduction, compared with a straight reactance calculation.

The event recordings contain prefault and fault voltages, currents, relay element states, contact output states, and contact input states. These data are displayed, upon command, in a one-page event report, which may be locally or remotely accessed through either communications port. This data sheet includes a sample event report.

Automatic self tests check power supply voltages, analog channel offsets, memory, and the analog-to-digital converter. The SEL-121 relay automatically reports self test status if an exceptional condition develops. You may inspect self test status on command at any time. Combined with the communications capabilities, automatic self testing features enhance protection availability, because any problem is immediately detected and reported. (Compare this to conventional relays, which are infrequently tested. The mean time to detect a failure is one-half the maintenance interval, which is measured in years.)

The SEL-121 relay accepts settings through its communications ports. Because of this feature, you can enter or change settings remotely with a dialup modem. This feature saves travel and maintenance time, and makes it possible to conveniently adapt the protection to unusual or emergency conditions.

The communications ports are carefully protected by two passwords and an alarm structure.

The SEL-121 relay is packaged in an all-metal enclosure. The drawout assembly is easily accessed by removing the front panel and contains virtually all the instrument's electronic devices, including the power supply. All control wiring connects to the SEL-121 relay rear panel on standard 10-32 screw terminals. The data ports use rugged twist-to-lock round connectors with gold-plated pins, ensuring secure connections.

Electromagnetic interference environmental security is designed into the SEL-121 relay. All field wiring is bypassed, filtered, and isolated from ground. Even the data ports have EMI protective devices on each line. The SEL-121 relay passes the IEEE SWC Test.

APPLICATIONS

Replacement of Outdated Protective Relays

The SEL-121 relay is the ideal replacement for obsolete electromechanical relays. Its compact size and simple field wiring make replacement especially convenient in crowded substations. Its event reporting and fault locating features economically provide valuable engineering and operating information, eliminating the need for event recorders and oscillographs in most applications. Its instrument transformer burden is negligible.

Time-Step Distance Relaying

The SEL-121 relay provides three zones of time-step distance protection with separate timers for phase and ground faults in each of the two time-step zones. In such applications, the SEL-121 relay is the only instrument needed for primary relaying. The exhaustive self testing and communications capabilities are features which reduce dependence on local and remote backup schemes.

Transfer Tripping Schemes

The SEL-121 relay supports direct, permissive underreaching, and permissive overreaching transfer tripping. These schemes are available simultaneously with the time-step distance schemes. The SEL-121 relay event report clearly displays the sequence of events of voltages, currents, relay elements, inputs, and outputs, simplifying assessments of scheme performance. For example, the report shows the relative timing between mho element operation, the transfer tripping output and input, the trip outputs, and the 52A breaker status input.

Backup Relaying Schemes

The SEL-121 relay is an ideal backup relay for many reasons. As conditions change, you can change any of its settings remotely, including independent enabling and disabling of each zone.

For example, consider an important line already protected by two fully redundant terminals. The SEL-121 relay might be used as backup, with its Zones 2 and 3 enabled for time-step tripping. When either primary scheme is out of service, Zone 1 of the SEL-121 relay could be enabled as well.

Applying the SEL-121 relay in this example also carries the benefits of fault locating and event recording, at great economy.

Fault Locating

The SEL-121 relay can be applied economically as a single-end fault locator. It provides more accurate results than using oscillographic records. More importantly, the fault location is immediately available from remote locations, eliminating the delay and expense of locating faults from oscillograms. Thus, fault locating can be used as an operational tool to determine where a circuit should be sectionalized, from where maintenance is most economically dispatched, and whether manual reclosing should be attempted.

Portable Unit/Test Instrument

Because the unit is compact, lightweight, and easy to install, it can be applied as a portable unit, quickly installed to monitor lines where frequent faults are occurring, or where a temporary relaying scheme is needed.

Temporary connection as a test instrument while energizing transmission lines, transformers, and other apparatus provides convenient metering and event recording.

SPECIFICATIONS

Relay Functions

Mho characteristics for all fault types.
Mho units are sound-phase polarized.
Negative-sequence directional supervision.
Three zones of distance protection.
Separate zone timers for phase and ground faults.
Instantaneous positive-sequence overcurrent unit.
Instantaneous positive-sequence overvoltage unit.
Instantaneous negative-sequence overcurrent unit.
Instantaneous negative-sequence overvoltage unit.
Ground switch detection.
Blown potential fuse detection.
Automatic phase-sequence checking of voltages and currents upon power-up.
Single-pole tripping outputs.
Automatic reclosing for Zone 1 and Zone 2 faults (cleared by transfer tripping) except three-phase faults.
Settable phase overcurrent units supervise mho elements.

Operating Time

10 - 32 ms; 20 ms typical, including output relay delay.

Steady-State Error

Less than 3% of set reach (distance relays)

Transient Overreach

Less than 5% of set reach.

Fault Location

Algorithm compensates for prefault load flow and fault resistance for improved accuracy over a wide range of system conditions. Demonstrated accuracy is about one percent of line length. Fault location is reported in miles and secondary ohms.

Fault Reporting

After each fault, the relay transmits a data record including time, fault type and location, relay settings, and units which operated. Phasor information on currents and voltages indicates prefault, fault, and postfault conditions. This report may also be generated upon command or triggered by a contact closure. The state of all contact inputs and outputs is also reported.

Self Testing

Checks analog ac channels for offset errors. Stall timer monitors processor and five-volt supply. Power supply voltage level checking. Settings, RAM, ROM, and A/D converter checking. These self tests are designed to detect virtually any hardware or firmware failure. Failure of any test generates an alarm message and closes alarm contacts. Critical failures disable protection and control to prevent misoperation.

Reach Setting

Zone 1: 0.125 to 32 ohms
Zones 2 and 3: One to 16 times Zone 1 for Zone 1 settings up to 8 ohms. One to four times Zone 1 for Zone 1 settings above 8 ohms.

Signal Inputs	Three voltage channels (67 V L-N nominal) Three current channels (5 A nominal; 390 A for 1 sec.) Demodulated, isolated IRIG-B input for time synchronization.
Setting Means	Digital, via serial communications ports. Operator enters settings in response to prompting messages. Line constants are entered in primary ohms. Line length and CT, PT ratios are entered; the relay displays quantities scaled into primary units (e.g. miles, kV, A). The SEL-121 relay retains settings in nonvolatile memory in two identical arrays; self tests compare these arrays. Should a test detect any differences, the relay generates an alarm and disables control functions to prevent misoperation.
System Outputs and Inputs	Seven relay outputs rated for breaker tripping (30 amp make for 1 second; 5 amp make, continuous). Six optically-isolated contact inputs, two serial communications ports (RS-232-C) for use with CRT, printing terminal, printer, modem, computer, etc. Ports are EMI protected. Time code input.
Indicators	Eight LED indicators normally provide fault targeting. The display may be used for testing purposes upon command.
Power Supply	90-130 Vac or 80-200 Vdc; 15 watts Other voltage ranges available.
Surge Filtering	Power supply line filter. All control inputs and outputs bypassed to ground. Contact inputs filtered by RC networks. Relay outputs protected by MOVs. SWC tested to ANSI C37-90 specifications.
Dimensions	5¼" x 19" x 13" (13.3 cm x 48.2 cm x 33.0 cm) (H x W x D)
Mounting	Mounts in standard 19" relay rack. Available in vertical or horizontal mounting configurations.
Unit Weight	21 lbs (9.1 kg), shipping weight 32 lbs (14.1 kg), including two manuals.
Operating Temp.	-4°F to 131°F (-20°C to 55°C)

SAMPLE EVENT REPORT

Example 230 kV Line Date: 1/1/91 Time: 01:20:31.426

	Currents (amps)			Voltages (kV)			MHO	+Seq	-Seq	Outs	Ins
/K*RES	A	B	C	A	B	C	ABCABC GGGBCA	iIv	ivV3 2	TCTTTTA PLTABCL	DTBD5E TTTC2T
-13	-13	0	0	82.3	-129.4	-10.1	.....	..*	.*..	.....	....*.
31	35	3	0	49.4	58.4	-141.6	.....	..*	.*..	.....	....*.
13	13	0	3	-82.1	129.6	9.8	.....	..*	.*..	.....	....*.
-31	-38	0	0	-49.6	-58.2	141.7	.....	..*	.*..	.....	....*.
-13	-13	0	0	82.0	-129.6	-9.5	.....	..*	.*..	.....	....*.
35	35	0	0	49.8	57.8	-141.7	.....	..*	.*..	.....	....*.
9	13	0	0	-82.0	-129.7	9.2	.....	..*	.*..	.....	....*.
-35	-31	3	0	-49.9	-57.5	141.6	.....	..*	.*..	.....	....*.
-9	-13	0	0	81.9	-129.8	8.8	.....	..*	.*..	.....	....*.
35	31	-3	0	50.0	57.3	-141.7	.....	..*	.*..	.....	....*.
9	13	0	0	-81.8	129.8	8.4	.....	..*	.*..	.....	....*.
-35	-31	3	3	-46.0	-52.6	142.1	.....	..*	.*..	.....	....*.
13	13	0	0	83.2	-128.4	-8.0	.....	..*	.*..	.....	....*.
252	252	0	0	40.2	45.8	-142.4	.....	*.*	**..	.....	....*.
111	113	0	0	-83.4	128.2	7.5	.....	*.*	**..	.....	....*.
-823	-827	0	0	-43.9	-48.9	142.3	2....	*.*	**.*	.....	....*.
-358	-371	0	0	81.8	-129.8	-7.2	1....	*.*	**.*	*.**...	....*.
1217	1224	0	0	50.0	54.9	-142.1	1....	*.*	**.*	*.**...	....*.
469	491	3	0	-81.2	130.5	7.0	1....	*.*	**.*	*.**...	....*.
-1265	-1268	0	0	-51.0	-55.6	142.0	1....	*.*	**.*	*.**...	....*.
-491	-516	-3	0	81.0	-130.7	-6.6	1....	*.*	**.*	*.**...	.....
1274	1277	0	0	51.4	55.4	-142.0	1....	*.*	**.*	*.**...	.....
500	516	3	0	-81.0	130.8	6.3	1....	*.*	**.*	*.**...	.....
-1274	-1277	0	0	-51.5	-55.1	142.0	1....	*.*	**.*	*.**...	.....
-496	-510	0	0	81.0	-130.8	-6.1	1....	*.*	**.*	*.**...	.....
1279	1280	0	0	52.5	55.7	-141.7	1....	*.*	**.*	*.**...	.....
487	507	0	0	-81.5	130.2	5.6	1....	*.*	**.*	*.**...	.....
-1199	-1202	0	0	-53.1	-55.9	141.6	1....	*.*	**.*	*.**...	.....
-288	-308	3	3	81.3	-130.4	-5.2	1....	*.*	**.*	*.**...	.....
730	733	0	0	52.4	54.6	-141.8	2....	*.*	**.*	*.*....	.....
58	69	0	-3	-80.5	131.2	5.1	2....	*.*	**.*	*.*....	.....
-204	-211	0	0	-52.2	-54.0	142.0	.....	*.*	**..	.....	.....
-22	-25	0	0	80.4	-131.4	-4.9	.....	*.*	**..	.....	.....
49	53	0	3	52.4	53.9	-141.7	.....	..*	.*..	.....	.....
13	16	0	0	-80.4	131.3	4.5	.....	..*	.*..	.....	.....
-31	-35	0	0	-52.5	-53.4	141.7	.....	..*	.*..	.....	.....
-9	-16	0	0	80.3	-131.5	-4.2	.....	..*	.*..	.....	.....
27	35	0	0	52.5	53.0	-142.0	.....	..*	.*..	.....	.....
9	16	0	0	-80.0	131.7	4.0	.....	..*	.*..	.....	.....
-27	-35	0	0	-52.7	-52.8	142.1	.....	..*	.*..	.....	.....
-9	-13	0	0	79.8	-131.7	-3.7	.....	..*	.*..	.....	.....
27	31	0	0	53.0	52.6	-142.1	.....	..*	.*..	.....	.....
9	13	0	0	-79.8	131.8	3.4	.....	..*	.*..	.....	.....
-27	-31	3	0	-53.2	-52.4	142.0	.....	..*	.*..	.....	.....

Event : 1AG Location : 50.28 mi 4.08 ohms seq
Duration: 4.00 Flt Current: 1378

R1 = 13.90	X1 = 79.96	R0 = 41.50	X0 = 248.57	LL = 100.00	
CTR = 200	PTR = 2000	MTA = 80.80	79OI= 30.00	79RS = 60.00	
Z1% = 80.00	Z2% = 120.00	Z2DG= 60.00	Z2DL= 30.00		
Z3% = 150.00	Z3DG= 90.00	Z3DL= 60.00	50FD= 100	46PH = 6000	TTI = 1
Z1E = Y	Z2E = Y	Z3E = Y	32QE= Y	GSE = Y	BPFE= Y

EXPLANATION OF SEL-121 EVENT REPORT

```
Example 230 kV Line                          Date: 1/1/91        Time: 01:26:31.426

          Currents                    Voltages                MHO
+Seq -Seq Outs     Ins                 (amps)                  (kV)
                                                    ABCABC  iIv ivV3 TCTTTTA DTBD5E
K*RES     A        B      C       A       B       C  GGGBCA        2 PLTABCL TTTC2T

 -823    -827      0      0    -48.9   -48.9   142.3  2.....  *.* **.* ....... ....*.

 -358    -371      0      0     81.8  -129.8    -7.2  1.....  *.* **.* * *.**... ....*.
 1217    1224      0      0     50.0    54.9  -142.1  1.....  *.* **.* * *.**... ....*.
  469     491      3      0    -81.2   130.5     7.0  1.....  *.* **.* * *.**... ....*.
-1265   -1268      0      0    -51.0   -55.6   142.0  1.....  *.* **.* * *.**... ....*.

Event   :1AG     Location   : 50.28  mi  4.08   ohms sec
Duration: 4.00   Flt Current: 1378

R1  = 13.90      X1  = 79.96     R0  = 41.50     X0  = 248.57    LL   = 100.00
CTR = 200        PTR = 2000      MTA = 80.80     79OI = 80.0     79RS = 60.00
Z1% = 80.00      Z2% = 120.00    Z2DG= 60.00     Z2DL = 30.00
Z3% = 150.00     Z3DG= 90.00     Z3DL= 60.00     50FD = 100      46PH = 6000     TTI = 1
Z1E = Y          Z2E = Y         Z3E = Y         32QE = Y        GSE  = Y        BPFE= Y
```

Currents and voltages are in primary amps and kV. Lines are ¼ cycle apart. Time runs down page. Obtain RMS value and angle using one value as Y component, and the entry immediately below as X component. For example, from bottom rows, IAY = 491, IAX = -1268. Therefore, IA = 1360 amperes RMS primary, at an angle of ATAN(491/-1268) = -21 degrees, with respect to sampling clock. Notation /K*RES indicates residual current, shifted by angle of residual current compensation factor (Z0-Z1)/Z1.

<mho> columns show states of mho elements for AG, BG, CG, AB, BC, CA faults. Number indicates zone: 1 - Zone 1; 2 - Zone 2; 3 - Zone 3.

<+Seq> columns show states of positive-sequence elements: i - sensitive overcurrent; I - high-set instantaneous; v - sensitive overvoltage.

<-Seq> columns show states of negative-sequence elements: i - sensitive overcurrent; v - sensitive overvoltage; V - overvoltage for open-phase detection; 32 - negative-sequence directional element.

<Outs> columns indicate output relay states: TP - trip; CL - close; TT - transfer trip initiate; TA-trip A; TB-trip B; TC-trip C; AL - alarm.

<Ins> columns indicate contact input states: 52 - 52A; DT - direct trip; TT - transfer trip; BT - block trip; DC - direct close; ET - external trigger.

<Event> Fault type indication is one of the following: AG,BG,CG = single-phase, AB,BC,CA = two-phase, ABG,BCG,CAG = two-phase to ground, ABC = three-phase followed by a "T" if a TRIP triggered the report. Other indication is EXT = externally or otherwise triggered.

<Location> Distance to fault in miles. INDT is indeterminate distance.

<ohms sec> Distance to fault in secondary ohms.

<Duration> Fault duration (cycles) is determined from mho elements.

<Flt current> Fault current (primary amperes) is taken near middle of fault.

<Relay Settings>

R1,X1,R0,X0: Primary series impedance settings for transmission line.

LL: Line length corresponding to specified line impedances.

CTR, PTR: Current and potential transformer ratios.

MTA: Maximum torque angle (degrees) for mho circles.

79OI,79RS: Reclose open and reset intervals.

Z1%,Z2%,Z3%: Reaches of mho circles, as percent of line length (LL).

Z2DG,Z3DG: Zone timers for ground faults.

Z3DL,Z3DL: Zone timers for phase-to-phase faults.

50FD: Fault detector pickup.

46PH: High-set positive-sequence overcurrent primary current setting.

TTI: Transfer trip initiate output closes for Zone 1, 2, or 3 faults.

Z1E,Z2E,Z3E: Zones 1, 2, and 3 may be enabled or disabled.

32QE: Enable or disable negative-sequence directional supervision of mhos.

GSE: Block when closing in on ground switches is detected.

BPFE: Block if a blown potential fuse is detected.

SAMPLE COMMAND DISPLAYS

HISTORY

HISTORY displays the date, time, type of event, distance (if event is a fault), duration, and current for each of the last twelve events. In the following sample display, only four faults have occurred since the relay was turned on. The SEL-121 relay stores the last twelve events.

```
=>>HISTORY <ENTER>

     DATE      TIME      TYPE      DIST      DUR       CURR

  10/31/91   09:03:01    3AG      100.2      7.2        798
  10/31/91   09:02:13    3AG       74.9      7.0       1016
  10/31/91   09:00:39    1AG       25.3      7.2       2162
  10/31/91   09:00:13    1BC       25.5      7.2       3167
```

METER

METER shows primary-scaled line-to-neutral and line-to-line currents and voltages and total three-phase real and reactive power.

```
=>>METER <ENTER>

Example 230 kV Line                    Date: 1/1/91       Time: 01:03:01

                A         B         C         AB        BC        CA

I (A)        1002       999      1000      1734      1732      1730
V (kV)      134.1     133.8     133.6     232.2     231.5     232.1

P (MW)      232.43
Q (MVAR)      0.56
=>
```

STATUS

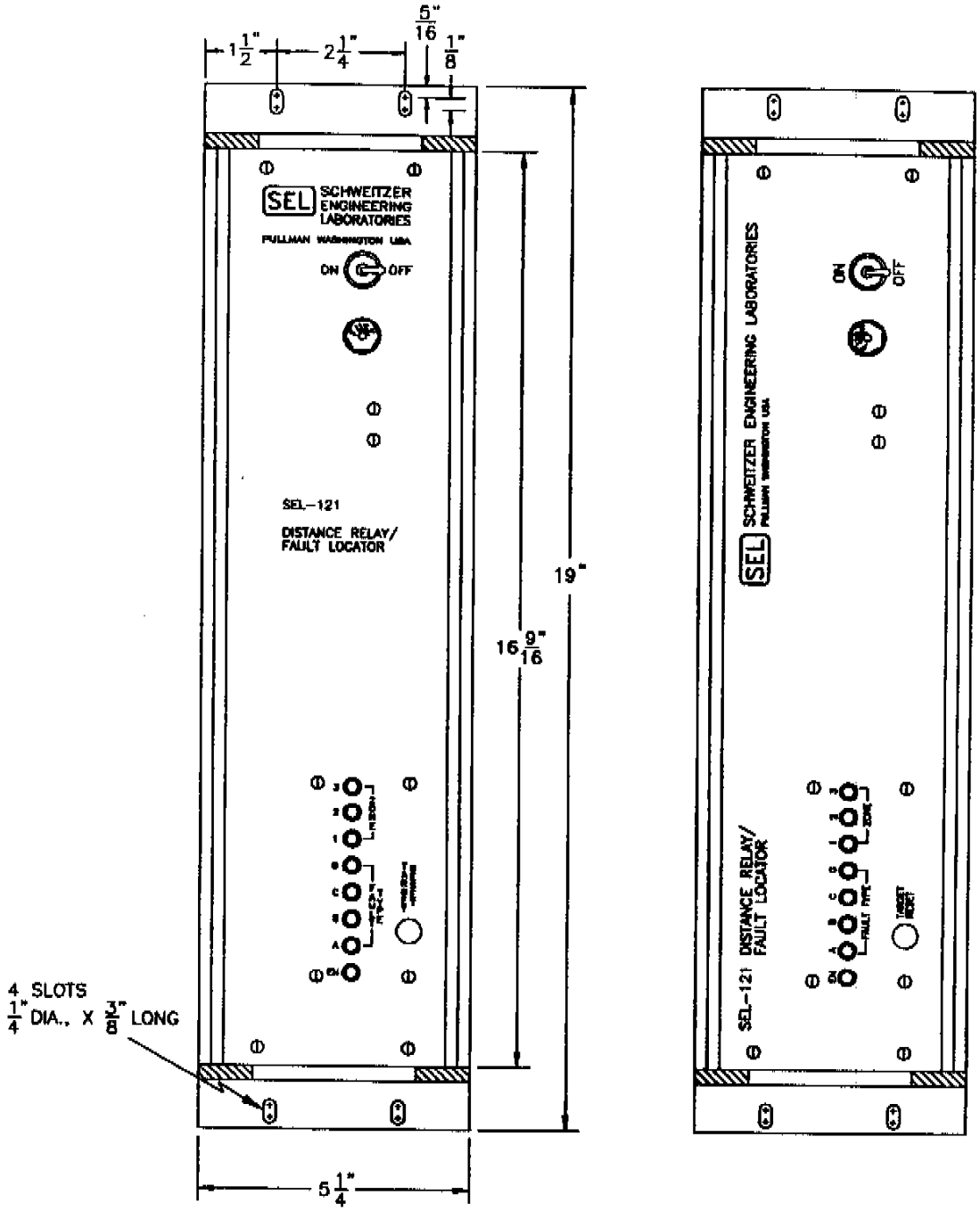
STATUS displays relay self test status.

```
=>>STATUS <ENTER>

SELF-TEST STATUS          Example 230 kV Line          1/1/91      01:02:31

W=Warning  F=Failure

      IR    IA    IB    IC    VA    VB    VC

OS    0     0     0     0     0     0     0
PS      5.07        15.07        -14.79
RAM   ROM       A/D         MOF       SET
OK    OK        OK          OK        OK
```

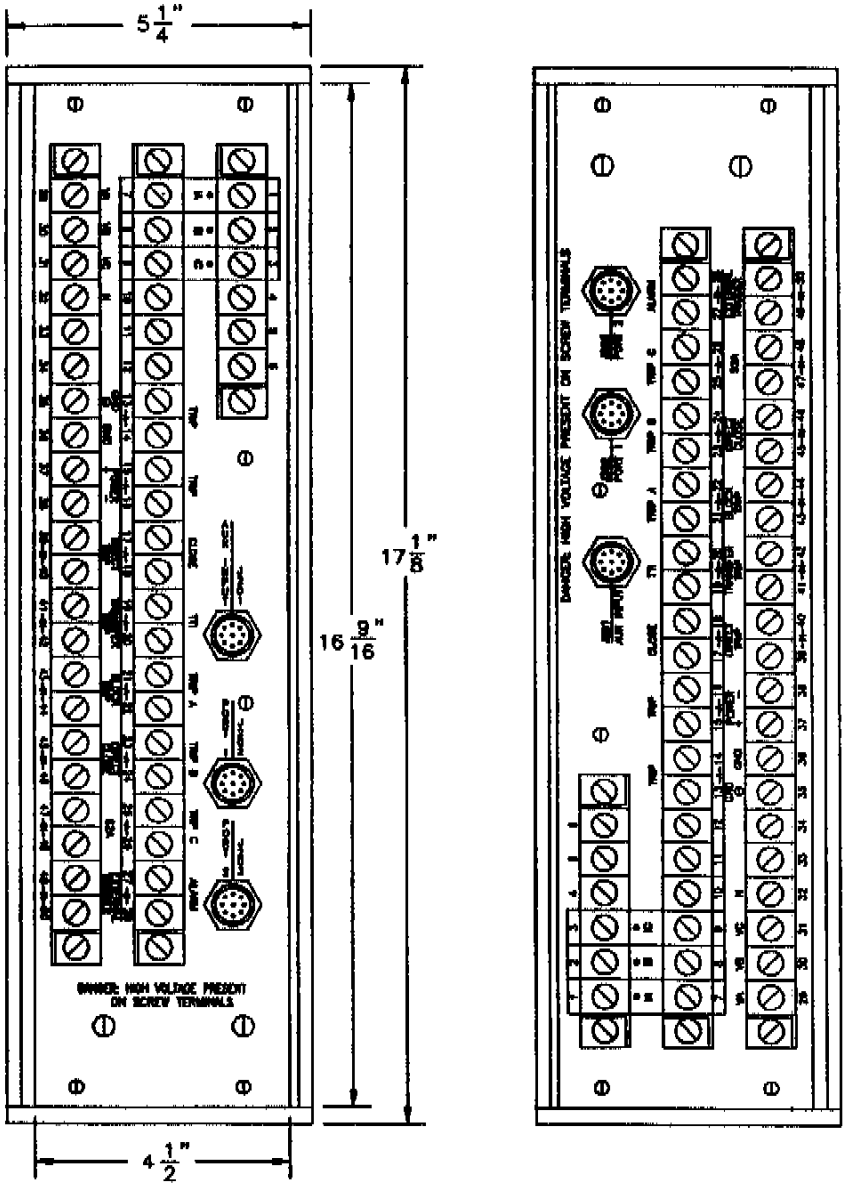
SET

SET allows entry of relay settings. In the following display example, note that the operator changed the reach of Zone 1 from 80% to 85%.

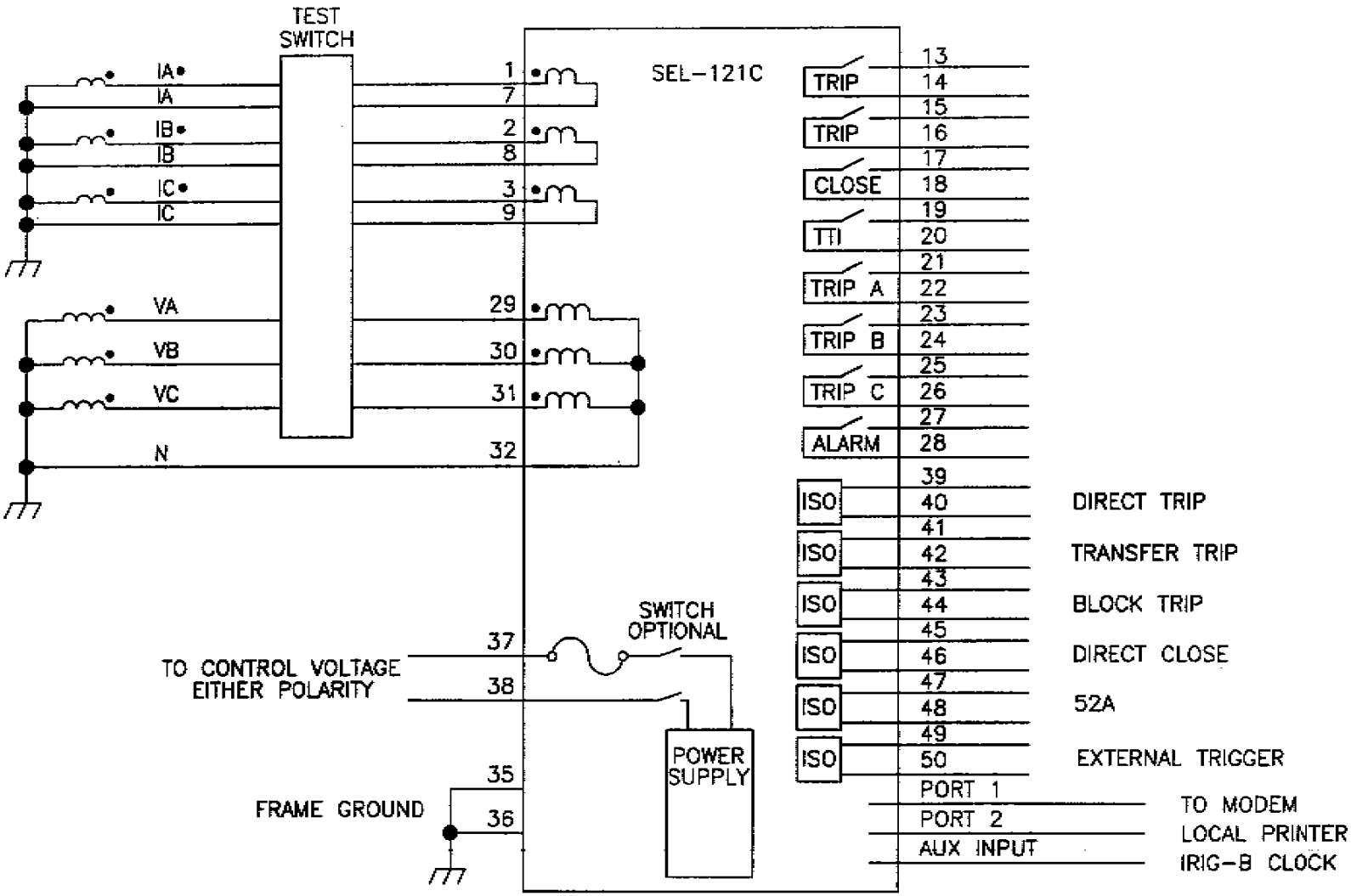
```
=>>SET <ENTER>

Enter data or RETURN for no change

Relay ID =
Example 230 kV Line
?

R1 (ohms pri) = 13.90  ?
X1 = 79.96  ?
RO = 41.50  ?
XO = 248.57 ?
Line Length (mi) = 100.00 ?
CT Ratio = 200  ?
PT Ratio = 2000 ?

Max Torque Ang (deg) = 80.80  ?
79 Open Interval (cy) = 30.00 ?
79 Reset Timer (cy) = 80.00  ?
Z1 Reach (% line) = 80.00  ? 85
Z2 Reach (% line) = 120.00  ?
Z2 Delay-Ground (cyc) = 60.00  ?
Z2 Delay-Line   (cyc) = 30.00  ?
Z3 Reach (% line) = 150.00  ?
Z3 Delay-Ground (cyc) = 90.00  ?
Z3 Delay-Line  (cyc)  = 60.00  ?
50FD Pickup (A pri) = 100
+Seq OC Thrsh (A pri) = 6000  ?

Trans Trip Init Zone  (1,2,3) = 1 ?
Zone 1 Direct Trip (Y/N) = Y ?
Zone 2 Direct Trip (Y/N) = Y ?
Zone 3 Direct Trip (Y/N) = Y ?
Neg Seq Dir Supervsn (Y/N) = Y ?
Ground Switch Det (Y/N) = Y ?
Blown Pot Fuse Det (Y/N) = Y ?

New settings for:
Example 230 kV Line
R1  = 13.90    X1  = 79.96   RO  = 41.50   XO  = 248.57   LL  = 100.00
CTR = 200      PTR = 2000    MTA = 80.80   79OI= 30.00    79RS= 80.80
Z1% = 85.00    Z2% = 120.00  Z2DG= 60.00   Z2DL= 30.00
Z3% = 150.00   Z3DG= 90.00   Z3DL= 60.00   50FD= 100      46PH= 6000     TTI = 1
Z1E = Y        Z2E = Y       Z3E = Y       32QE= Y        GSE = Y        BPFE= Y

Enable with new settings (Y/N) ? Y
Calculating internal settings...
Enabled with new settings  -  1/1/91     01:05:44
=>>
```



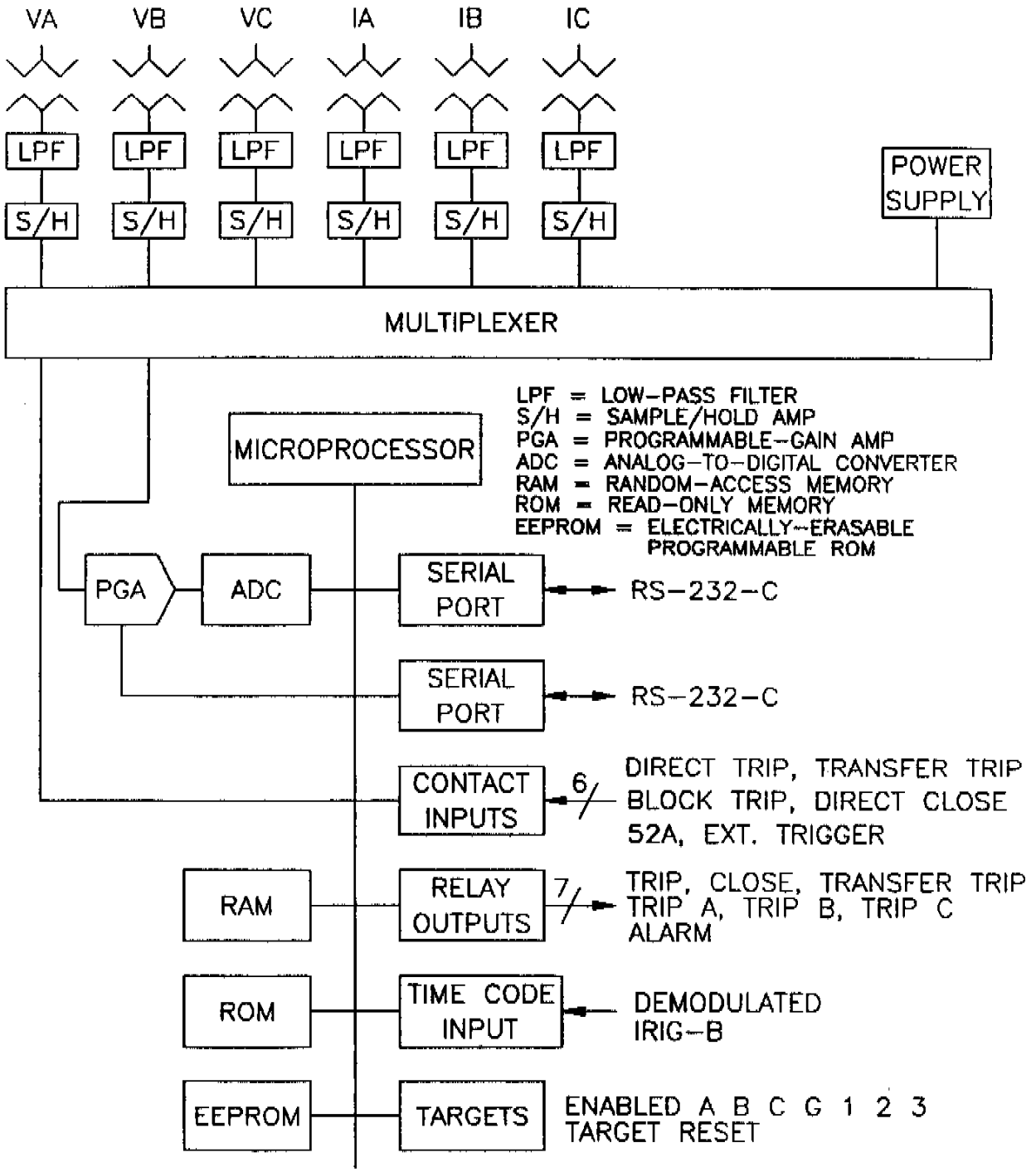
SEL–121 VERTICAL AND HORIZONTAL
FRONT PANEL DRAWING



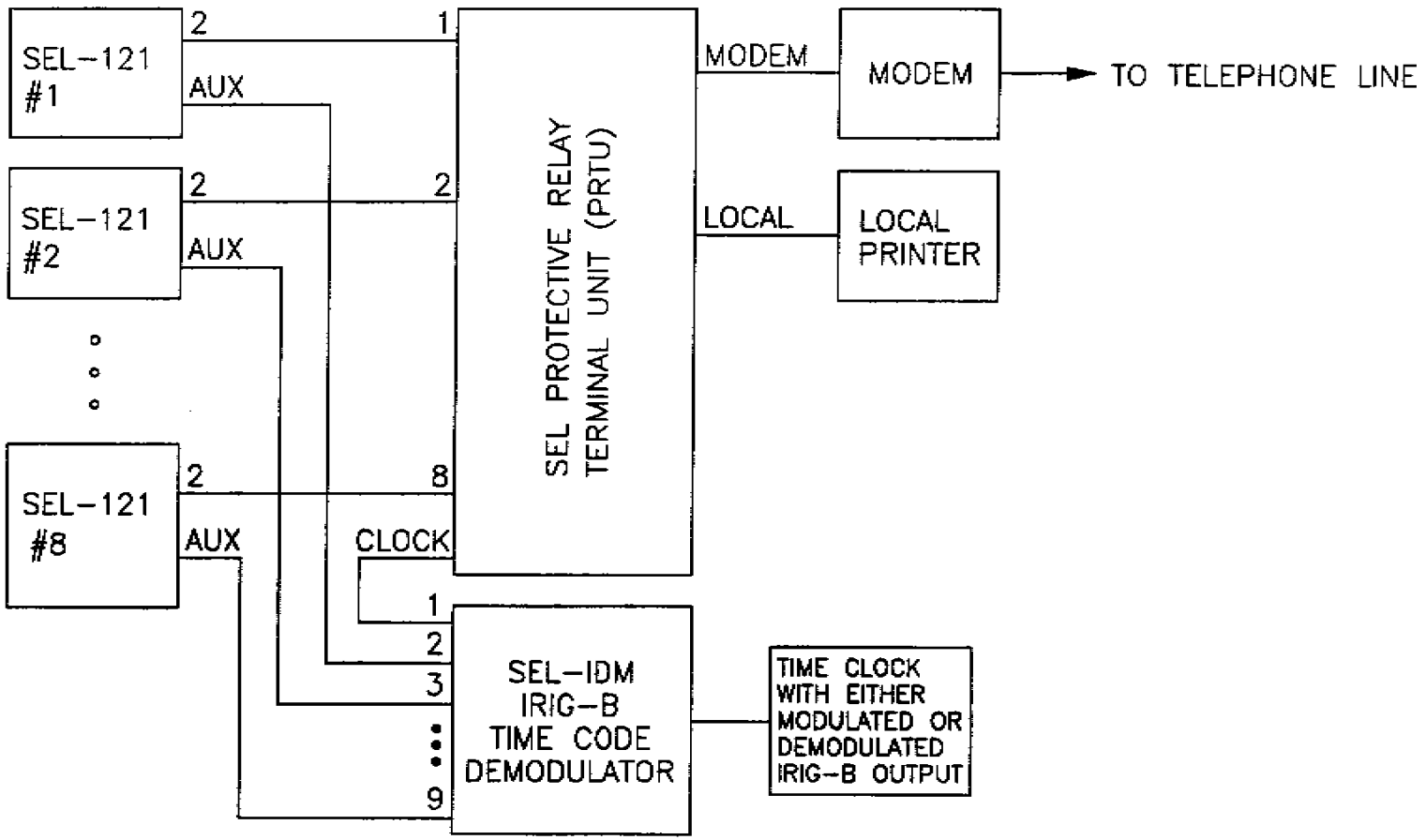
SEL–121 VERTICAL AND HORIZONTAL
REAR PANEL DRAWING



SEL-121 EXTERNAL CONNECTION DIAGRAM



SEL-121 BLOCK DIAGRAM



SEL–121 COMMUNICATIONS AND CLOCK CONNECTIONS
MULTIPLE UNITS AT ONE LOCATION

SEL-121 DISTANCE RELAY/FAULT LOCATOR COMMAND SUMMARY

Access Level 0

ACCESS	Answer password prompt (if password protection enabled) to enter Access Level 1. Third unsuccessful attempt pulses ALARM relay closed.

Access Level 1

2ACCESS	Answer password prompt (if password protection enabled) to enter Access Level 2. This command always pulses the ALARM relay.
DATE	Show or set date. DAT 6/15/91 sets date to June 15, 1991. IRIG-B synchronization overrides month and date settings.
EVENT	Show event record in long or short form. EVE 1 L shows the long form of the newest event report. EVE 12 shows the short form of the oldest event report.
HISTORY	Show DATE, TIME, EVENT TYPE, FAULT LOCATION, DURATION, and CURRENT for the last twelve faults.
IRIG	Force immediate execution of time code synchronization task.
METER	Show primary current, voltage, and real and reactive power. METER runs once. METER N runs N times.
QUIT	Return to Access Level 0.
SHOWSET	Display relay settings without affecting them.
STATUS	Show self test status.
TARGETS	Show data and set target lights as follows: TAR 0: Relay Targets TAR 1: Zone 1 mho elements TAR 2: Zone 2 mho elements TAR 3: Zone 3 mho elements TAR 4: Aux elements TAR 5: Contact Outputs TAR 6: Contact Inputs TAR 7: Internal logic 1 TAR 8: Internal Logic 2 Always return to TAR 0 when finished, so LEDs display fault targets.
TIME	Show or set time. TIM 13/32/00 sets clock to 1:32:00 PM. IRIG-B synchronization overrides this setting.
TRIGGER	Trigger and save an event record (event type is EXT).

Access Level 2

AUTO	Show or select port for destination of automatically-generated messages. AUT 1 selects PORT 1. AUT 2 selects PORT 2. AUT 3 selects PORTS 1 and 2.
CLOSE	Close circuit breaker, if allowed by jumper setting.
INTERVAL	Show or set command timeout interval. Each port uses a separate timeout value. Executing INT 0 from PORT 2 disables PORT 2 timeout. INT 4 from PORT 1 sets a four minute timeout for PORT 1.
MODEM	Show or set number of rings before modem at PORT 1 answers.
OPEN	Open circuit breaker, if allowed by jumper setting.
PASSWORD	Show or set passwords. ALARM relay pulses momentarily when new passwords are set. PAS 1 OTTER sets Level 1 password to OTTER. PAS 2 TAIL sets Level 2 password to TAIL.
SET	Initiate setting procedure. ALARM relay closes while new settings are being computed and event data buffers are cleared.

Separate commands and parameters with a space, comma, semicolon, colon, or slash.

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