

**BE1-DFPR
DISTRIBUTION FEEDER
PROTECTION RELAY**

The BE1-DFPR is an integrated feeder supervision system. It includes protection and control functions and provides the information necessary to simplify feeder maintenance procedures. Provisions to facilitate set-up and testing operations are included.

FUNCTIONS

- PROTECTION
- CONTROL
- DATA PROCESSING
- COMMUNICATIONS
- SET-UP & TEST PROVISIONS

ADDITIONAL INFORMATION

INSTRUCTION MANUAL

Request publication 9-2315-00-990

DISPLAYS & SETTINGS MANUAL

Request publication 9-2315-00-991

TIMING CURVES

Request publication 9-2315-00-992

STANDARDS, DIMENSIONS & ACCESSORIES

Request bulletin SDA

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FUNCTIONS

PROTECTION

- 3 phase and neutral overcurrent.
- Breaker failure.
- Undervoltage for each phase.
- Frequency tripping/restoration.

CONTROL

- Multiple shot reclosing (4-shot).
- Reclosing may be controlled with external inputs.
- Accepts breaker, trip and close inputs.
- Protection may be adapted to system conditions.

DATA PROCESSING

- Measures Watts, Var, VA, pf, f, V or I.
- Calculates present and stores minimum and maximum demand values.
- Accumulates data on breaker duty.
- Stores fault/event reports.
- Output contacts provide status information for SCADA.

COMMUNICATIONS

- Menu driven operation.
- Front and rear panel RS-232 ports.
- May use terminal or PC with off-the-shelf software.

SET-UP & TEST PROVISIONS

- Standard connection/test plugs for testing in the case (option).
- Test module for control inputs (option).
- Test unit is available to simplify testing.
- Built-in self-checking capabilities.
- Built-in breaker trip circuit monitor.

FEATURES

The features listed below elaborate on the functions outlined above.

PROTECTION FEATURES

- Current and voltage sensing elements attenuate offsets and harmonics.
- Different time overcurrent curves may be selected for phase and neutral.
- Instantaneous overcurrent elements are provided for phase and neutral.
- Fixed time overcurrent elements are provided for phase and neutral.
- Tripping elements and the response of the reclosing section may be set for normal, cold load (Aux. 1) and emergency (Aux. 2) settings by control inputs.
- In addition to the main tripping outputs, an independent trip output may be programmed to operate on any of the protective functions.
- Control inputs are provided to block all fixed time overcurrent elements and/or the neutral fixed time and neutral time overcurrent elements.
- The breaker failure element may be initiated by any protective tripping function or a supervisory trip.
- A breaker fail alarm contact is provided to indicate breaker problems that occur before the breaker fail function is actually caused to operate.

CONTROL FEATURES

- The reclosing function includes inputs for initiate, drive-to-lockout, and enabling or disabling reclosing.
- The reclosing section of the relay is deactivated to prevent pumping when the breaker is tripped or closed through one of the control inputs.
- An output is provided to block the load tap changer on the substation transformer or voltage regulator during a fault clearing or restoration process.
- Overcurrent protective functions may be adapted through control inputs.

DATA PROCESSING FEATURES

- Data is formatted to display information in logical groups on computer or terminal.
- Demand values are calculated for phase currents, W, Var, and VA for intervals from one to sixty minutes.
- Data stored on breaker duty includes number of operations and the sum of the I² or I values interrupted.
- Fault/event data is stored for up to 40 breaker operations.
- Parameters being measured and/or stored may be displayed on the front panel.
- Status outputs are provided for targets and reclose functions.
- Battery backed-up clock provides date and time for reports.

FEATURES (continued)

COMMUNICATIONS FEATURES

- Front RS-232 port for observing menus and groups of data or set-up parameters via a portable computer terminal.
- Rear RS-232 port for connection to a communications link.
- Communications provides access to set-up parameters, real time data, and stored information.
- Relay settings may be uploaded/downloaded.
- Relay settings may be changed off-line with stand-alone software program BLDDFPR.EXE.
- Supports special application protocols (consult factory).

SET-UP AND TEST FEATURES

- Access to the connection/test plugs is achieved by removing the left section of the front panel.
- The optional test module provides the means to disconnect control inputs and apply test signals through the test points shown in figure 1.
- Front panel display for reading data and setting parameters is shown in figure 2.
- Menu driven procedures are user friendly. The menu structure is shown in figure 3.

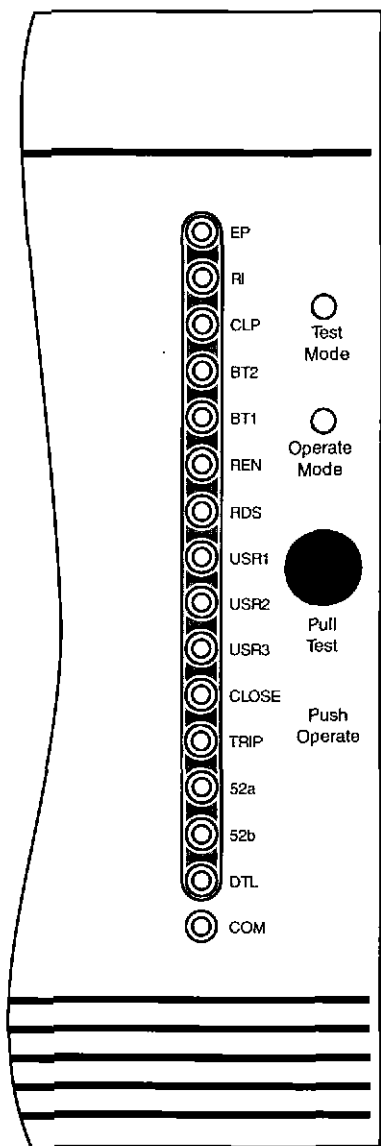


Figure 1 - Front Panel Test Points (option)

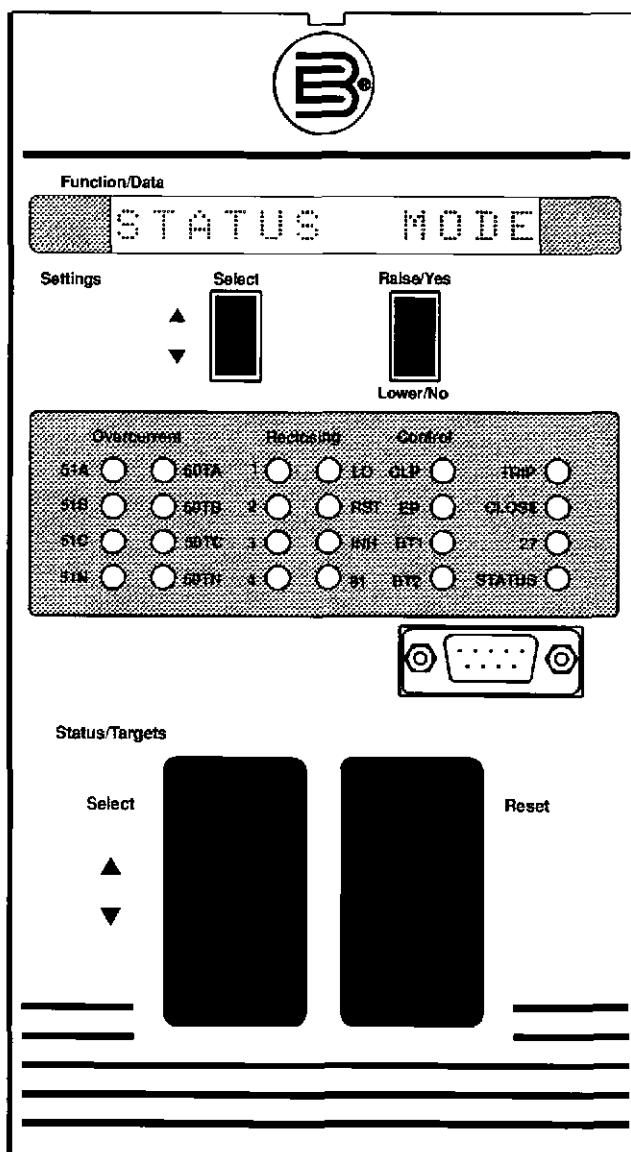


Figure 2 - Control Panel

FEATURES (continued)

Figure 3 illustrates the path through the menu structure and the required keystrokes to enter and exit each screen. A MAIN MENU provides selections for the main activities. REVIEW / EDIT SET-

TINGS MENU allows the user to select a complete group of settings. When the activity of the selected screen is complete, the user is returned to the menu for another activity selection.

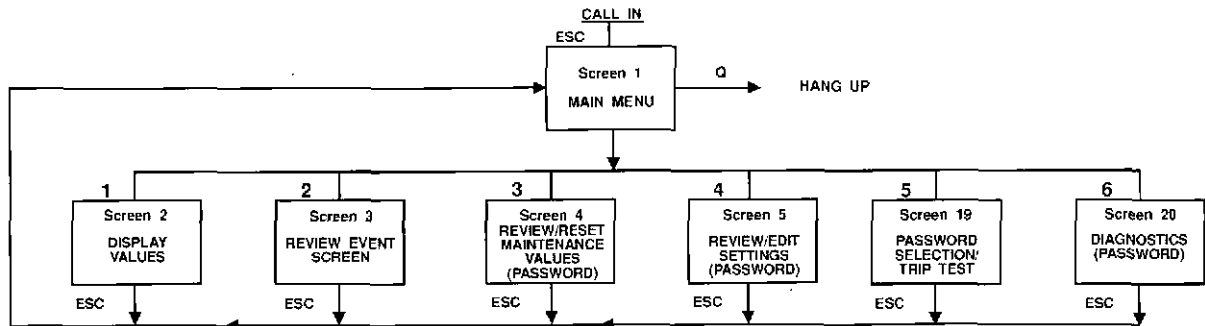
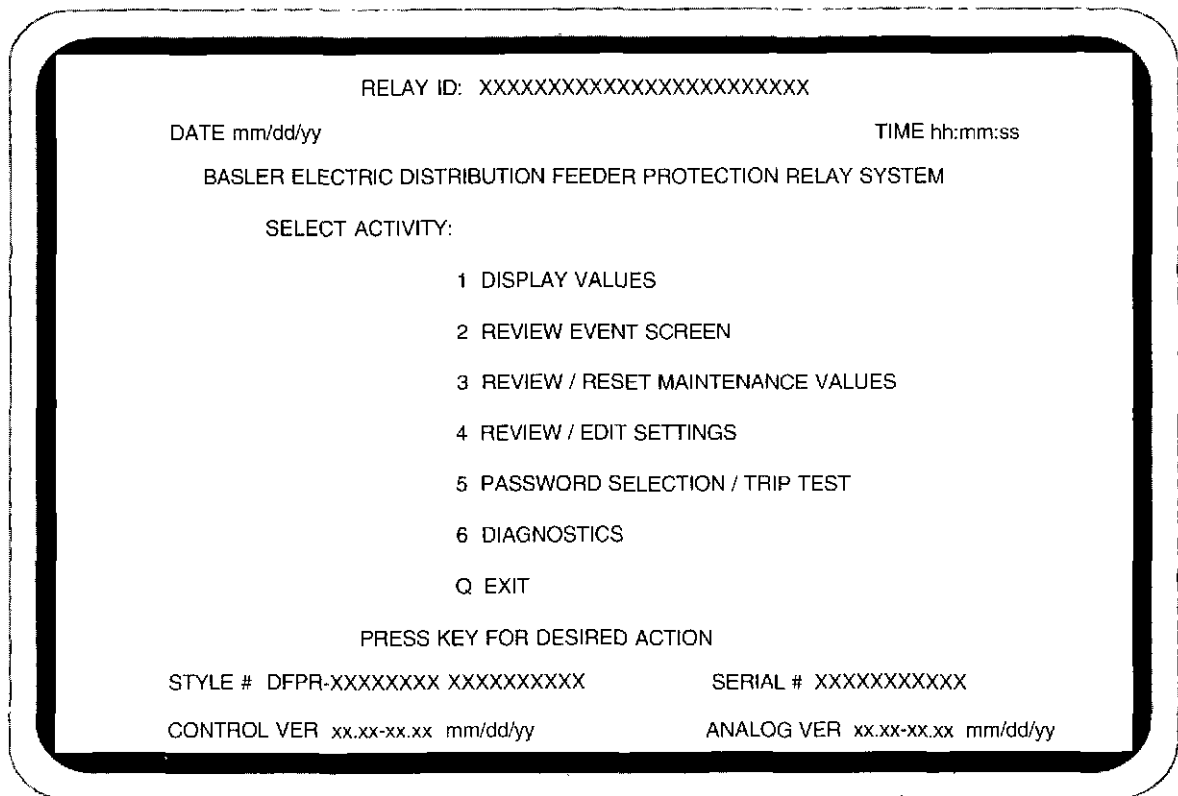


Figure 3 - Menu Structure



MAIN MENU SCREEN

The six selectable activity screens on the main menu are shown on the following three pages.

RELAY ID: XXXXXXXXXXXXXXXXXXXXXXXX

| | | | |
|--------------|------------------|-----------------------|---------------|
| | DATE mm/dd/yy | | TIME hh:mm:ss |
| | PRESENT VALUES | PRESENT DEMAND VALUES | TARGETS |
| PHASE | CURRENT VOLTAGE | | ELEMENT |
| A | xx.x KA xxx.x KV | xx.x KA | 50 A,B,C,N |
| B | xx.x KA xxx.x KV | xx.x KA | 50T A,B,C,N |
| C | xx.x KA xxx.x KV | xx.x KA | 51 A,B,C,N |
| N | xx.x KA | | 81 YES |
| | | | 27 RESET |
| | | | BF RESET |
| | | | PICKUP |
| WATT | xx.x KV | xx.x KW | 50T A,B,C,N |
| VAR | xx.x KVAR | xx.x KVAR | 51 A,B,C,N |
| VA | xx.x KVA | xx.x MVA | 81 YES |
| PF | xx % | | 27 RESET |
| FREQ | xx.xx Hz | | |
| BREAKER | OPEN | | |
| RELAY STATUS | ON LINE | TEST MODE | |
| RECLOSING | RESET | | |
| OP SETTING | NORMAL | | |
| INPUT STATUS | BT1 | BT2 | UP1 UP2 UP3 |

PRESS 'ESC' TO RETURN TO MAIN MENU

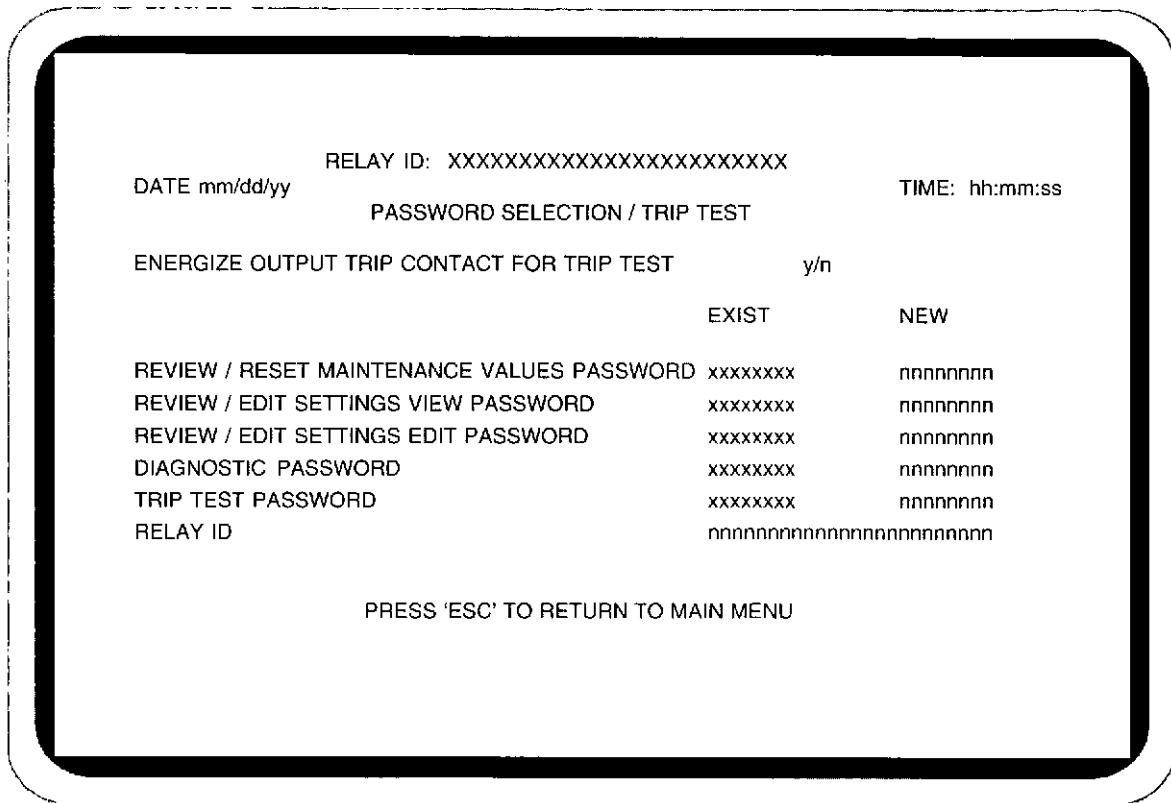
1. DISPLAY VALUES SCREEN - This screen displays the status of the power system element that is protected, i.e. a distribution line current flow, unbalance current (I_N), power flow.

RELAY ID: XXXXXXXXXXXXXXXXXXXXXXXX

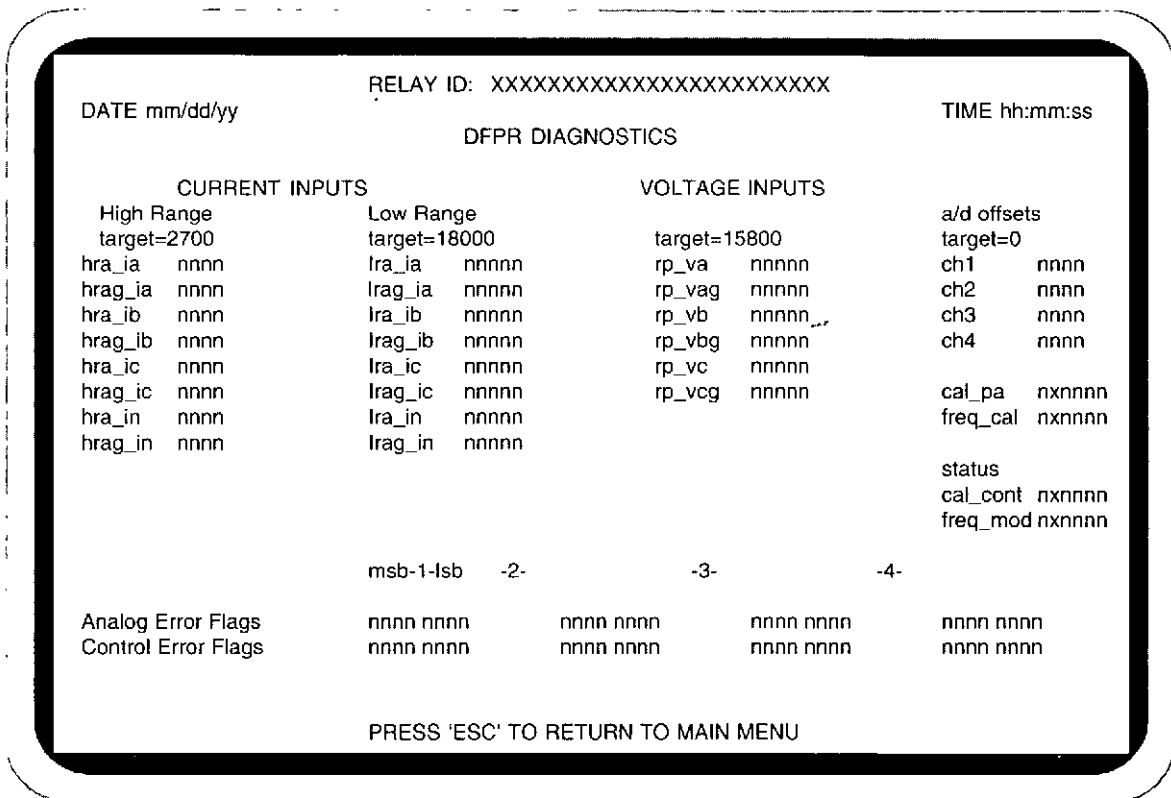
| | | | |
|---|------------------------|------------------------|--------------------------|
| DATE: mm/dd/yy | | | TIME: hh:mm:ss |
| | DFPR TRIP EVENT RECORD | | |
| EVENT # nn | TRIP | | |
| DATE: mm/dd/yy | TIME: hh:mm:ss.mm | TYPE: aaaaaaaaaa | |
| IA = n.nn KA | IB = n.nn KA | IC = n.nn KA | IN = n.nn KA |
| VA = n.nn KV | VB = n.nn KV | VC = n.nn KV | |
| TARGETS 50 A B C N | 50T A B C N | 51 A B C N | 81 RESET 27 RESET BF YES |
| IA2T = n.nn+Enn A^2sec | IB2T = n.nn+Enn A^2sec | IC2T = n.nn+Enn A^2sec | |
| BREAKER INTERRUPTION TIME = nnnnn msec | | | |
| BREAKER LIMIT STATUS: nnnnnnnn nnnnnnnnnnnn nnnnnnnnnnnn | | | |
| RECLOSE STATUS: nnnnnnn | | | |
| OPERATIONAL SETTING: aaaaaaa | | | |
| PROG ALARM: nnnnnnn nnnnnnnnn nnnnnnnnn nnnnnnnnn nnnnnnnnn nnnnnnnnn | | | |

PRESS 'P' FOR PRIOR, 'N' FOR NEXT & 'G' FOLLOWED BY xx FOR SPECIFIC RECORD
PRESS 'ESC' TO RETURN TO MAIN MENU

2. REVIEW EVENT SCREEN - This screen displays the last fault, or breaker operating event. Trip and close events are shown in sequence.



5. PASSWORD SELECTION / TRIP TEST SCREEN - The purpose of this screen is to define the passwords needed to enter various terminal screens and allow the output trip contact to be tested.



6. DIAGNOSTICS SCREEN - The purpose of this screen is to view diagnostic parameters in the DFPR for calibration and verification of proper operation. This screen requires a password for entry. Eight bit mapped bytes are used to show 4 error flags for the analog card and 4 error flags for the control card.

APPLICATIONS

The DFPR may be applied for improving protection schemes, implementing adaptive schemes, or providing maintenance information. The capabilities provided for each of these application areas are discussed in the following paragraphs.

IMPROVING PROTECTION SCHEMES

Distribution feeders represent the majority of circuits in a utility system. These circuits are typically radial, three-phase, and operate over the range of 2.4 to 35 kV. In a majority of distribution substations, circuit breakers are used to interrupt these circuits, with fuses and sectionalizers providing fault isolation downstream.

The primary types of relays used to protect feeders are overcurrent relays, usually with three phase-units and one for the neutral. The DFPR occupies about the same amount of panel space as three electro-mechanical overcurrent relays.

When the multiphase DFPR is used, a backup scheme must be considered. One approach is to equip the DFPR with the optional redundant power supply. But, for complete redundancy, use of three Basler BE1-50/51M relays is an economical approach.

The overcurrent elements in the DFPR are tuned to the fundamental frequency (50/60 Hz) and, thereby, reject offsets and harmonics. This provides the means to achieve more sensitive neutral overcurrent protection in feeders with high harmonic content.

In addition to overcurrent protection, the DFPR includes undervoltage elements which may be used for undervoltage load-shedding applications. The DFPR also includes a complete multiple shot

reclosing unit with four shot capabilities. By integrating this function along with the protective functions, it is possible to program the reclosing system to respond in a specified manner to operations of the various tripping elements. This makes it possible to implement improved logic in the reclosing scheme.

The breaker fail initiate output (BFI) may be used to activate a breaker fail scheme. This involves tripping a breaker or breakers upstream from the one that failed.

The DFPR includes the means to selectively trip individual feeders on underfrequency conditions and to automatically restore them at selected frequencies.

IMPLEMENTING ADAPTIVE SCHEMES

One adaptive capability of the DFPR is to revert to normal, cold load or emergency setting groups in accordance with the control inputs applied to the relay.

The DFPR can be programmed to automatically revert to cold load settings if the feeder has been dead for a preset time. Normal settings will be restored after the feeder has been energized for ten minutes.

The DFPR includes a control input for blocking all fixed time overcurrent elements. It also includes a control input for blocking neutral fixed time and neutral time overcurrent elements. Control inputs are also provided for enabling or disabling the reclose function. Three programmable inputs are provided for selecting functions such as external trigger event capture, reset of maximum/minimum demand levels and disabling of the 81 restore function.

APPLICATIONS (continued)

PROVIDING MAINTENANCE INFORMATION

The DFPR target and reclose function status output contacts may be interfaced with a SCADA system to give the operator additional information about what occurred on a feeder that tripped. This information is used to help guide maintenance personnel.

The DFPR, through communications, provides information about type of fault and approximate location by utilizing current magnitude before going to the substation. This information is obtained from the fault report under REVIEW EVENT SCREEN on the main menu. The report lists fault currents, voltages, targets, breaker operate time, reclose status, and general information.

Information is also provided by the DFPR to schedule breaker maintenance. This is in the form of number of breaker operations and accumulated contact wear. This information is accessible under REVIEW / RESET MAINTENANCE VALUES on the main menu.

The DFPR stores minimum and maximum demand values. This information can be retrieved periodically to keep track of load peaks and growth for planning purposes.

FUNCTIONAL DESCRIPTION

The DFPR is a microprocessor based system with the hardware modules shown in Figure 4.

External contact inputs (control inputs) are routed through the optional test panel module. Note that all control inputs are isolated from the electronics with optical isolators. The output from the contact sense module occurs on the data bus when the proper signals appear on the address and control buses.

AC inputs are routed through standard connection plugs to the magnetics module. These inputs consist of 4 currents and 3 voltages which are scaled and isolated with the current and voltage transformers in the magnetics module. The outputs from the magnetic modules are connected to the microprocessor data acquisition module. This module converts the analog signals to digital form and performs all protective functions. Trip signals are passed over the data bus to the output relay module as long as they have not been blocked by the control module. Analog values and target information are passed over the serial data link to the control module.

The microprocessor control module processes the serial data from the data acquisition module for all instrumentation and data logging functions. It also provides communications through the front and rear RS-232C ports and interfaces with the front panel display, controls, and indicators. All control functions, other than trip, are also provided by this module.

Two power supplies are shown in Figure 4. Only one is required to power the DFPR. The second one is optional and provides redundancy for users requiring that function.

Inputs and outputs are shown in Figure 5.

CURRENT INPUTS

Connections are provided for phase and neutral currents on terminals 13a through 20a. These inputs make connections to the relay through the top connection plug in the case.

VOLTAGE INPUTS

Connections are provided for 3 wire delta or 4 wire wye inputs on terminals 7a through 10a. These inputs make connections to the relay through the bottom connection plug in the case.

TRIP OUTPUTS

Two isolated sets of trip contacts are provided on terminals 1a-2a and 5a-6a. Each output is independently programmable in relation to which protective functions operate each output. These outputs make connections to the relay through the bottom connection plug in the relay case.

FUNCTIONAL DESCRIPTION (continued)

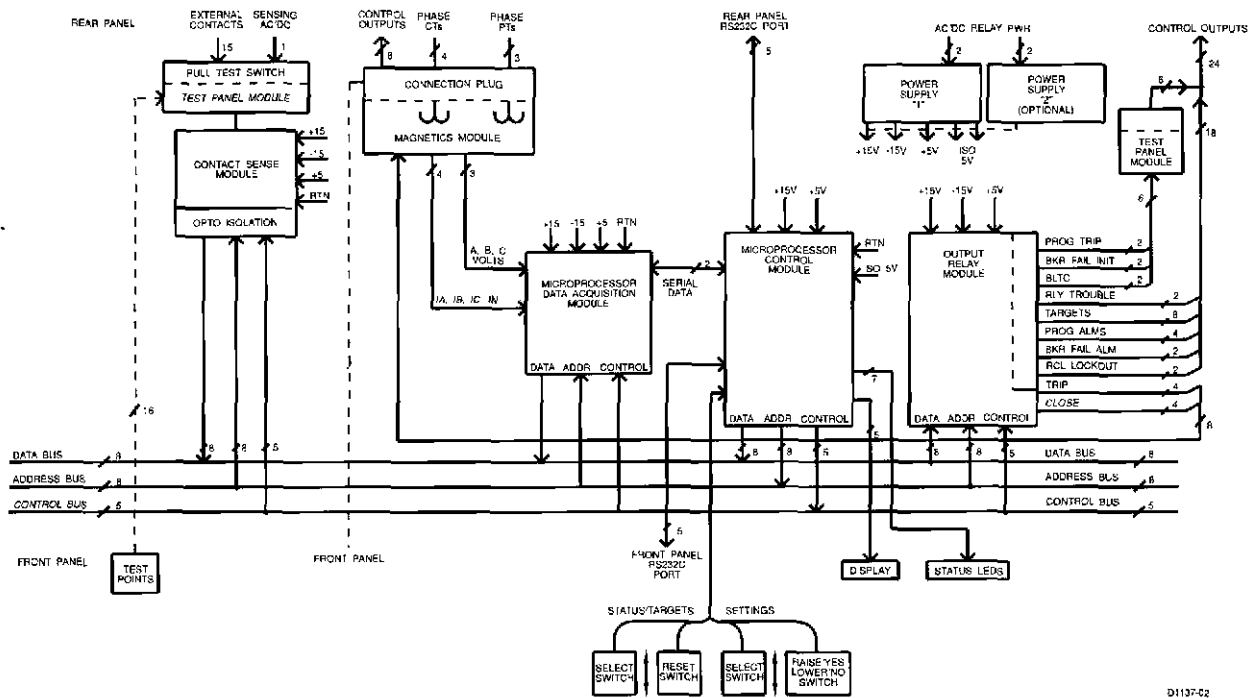


Figure 4 - Block Diagram

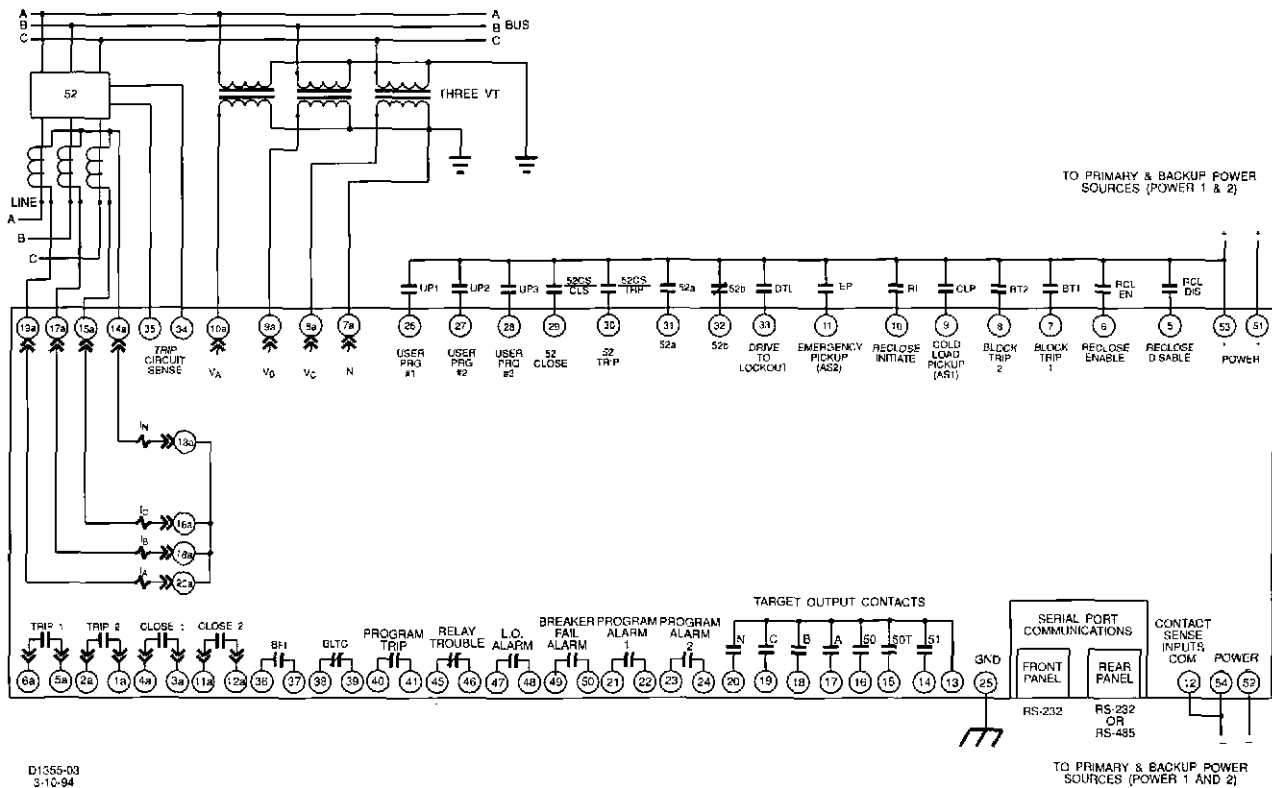


Figure 5 - External Connections

FUNCTIONAL DESCRIPTION

(continued)

Inputs and outputs are shown in figure 5.

CLOSE OUTPUTS

Two isolated sets of close contacts are provided on terminals 3a-4a and 11a-12a. Reclosing logic for each output is independently programmable. The first set makes connection to the relay through the bottom connection plug in the case, and the second connects to the relay through the top connection plug.

CONTROL INPUTS

Control input connections are made on terminals 5-11 and 26-33. All inputs should be connected to external wet contacts. A common return (minus) for all inputs is provided on terminal 12. Control inputs make connections to the relay through the optional test module. The control inputs and terminals () are as follows:

RCL DIS (5) Apply momentary input to disable reclosing. This input has priority over a RCL EN input.

RCL EN (6) Apply momentary input to enable reclosing.

BT1 (7) Block trip #1. Apply input to block tripping by the neutral instantaneous, neutral fixed time and neutral time overcurrent elements (50N, 50TN and 51N).

BT2 (8) Block trip #2. Apply input to block tripping by all fixed time overcurrent elements (50TA, 50TB, 50TC and 50TN).

EP (11) Emergency pickup. Apply input to activate the emergency relay settings (Aux. 2). This input has priority over cold load settings.

CLP (9) Cold load pickup. Apply input to activate the cold load relay settings (Aux 1).

RI (10) Reclose Initiate or block. Apply input to allow automatic reclosing. Remove input to block.

USR 1 (26) These inputs are independently programmable to trigger event
USR 2 (27) capture, disable 81 restore or reset
USR 3 (28) min/max demands to zero.

52 Trip (30) Apply input to issue a trip output. Momentary inputs cause the trip contacts to close for at least 200 milliseconds. This input will not initiate reclosing and will put the reclosing section in lockout mode. This input has priority over close.

52 Close (29) Apply input to issue a close output. Momentary inputs cause the close contacts to close for at least 200 milliseconds. This input also initiates the reclose reset timer.

52a (31) Connect to the 52a contact in the breaker and return the other side of the contact to the plus side of the control voltage. This input is used in conjunction with the breaker fail/indeterminate breaker functions. The function of this input may be disabled on in the installation settings screen.

52b (32) Connect to the 52b contact in the breaker and return the other side of the contact to the plus side of the control voltage. This input is used in conjunction with the breaker fail/ alarm functions. The recognition time of this input can be programmed from 8 to 100 msec (in 4 msec increments) in the installation settings screen.

DTL (33) Drive to lockout. Apply input to put the reclosing function into the lockout condition.

FUNCTIONAL DESCRIPTION (continued)

Inputs and outputs are shown in figure 5.

CONTROL OUTPUTS

Separate pairs of isolated contacts for control purposes are provided on terminals 36-41. The specific outputs and terminals () are listed below.

BFI (36-37) This is the breaker fail output. This contact closes if the breaker fails to open after receiving a trip command from one or more of the overcurrent or undervoltage elements as specified during the setup for this function (or from the supervisory input).

BLTC (38-39) The output contact is used to block the operation of a load tap changer or voltage regulator during the fault clearing and restoration process.

PT (40-41) This contact may be programmed by the user to close for any combination of trip conditions for all protective elements.

TARGET OUTPUTS

A group of seven contacts with a common connection provides target status information. The common connection is on terminal 13, and terminals 14-20 are connected to the output contacts. The targets are for the faulted circuits (A, B, C or N) and for the elements (50, 50T or 51). These are used to indicate the type of fault and do not include the 27, 81 or BF target functions.

ALARM OUTPUTS

Separate pairs of isolated contacts are provided for 5 alarm outputs. These outputs and terminals () are as follows:

Prog 1 (21-22) These alarm outputs may be
Prog 2 (23-24) programmed by the user to operate for one or more conditions established during the setting up process.

RT (45-46) This is a relay trouble alarm

contact. It opens for failure of power supply, microprocessor, memory test, A/D converter test and communications.

REC LO (47-48) This contact will close when the reclosing section of the relay is in the lockout condition.

BF (49-50) This contact provides an indication that a problem has been detected with the controlled circuit breaker. The contact closes if 1) a discontinuity is detected in the trip circuit, 2) the 52a and 52b contacts do not agree on breaker position, 3) the breaker did not close within the time set for the reclose fail timer, and 4) breaker operations count reaches limit.

TRIP CIRCUIT SENSE

Terminals 34 and 35 are connected internally to an optically isolated sense circuit. This feature is used by connecting these terminals across the trip output contacts with terminal 34 connected to the plus side. A discontinuity in the trip circuit will activate the BF alarm.

CONTROL POWER

Separate sets of terminals are provided for the main and optional redundant power supplies. This allows them to be run from different sources if desired.

COMMUNICATIONS

RS-485 connections are on terminals 2-4. These connections are for special applications and are not activated on the standard product. The standard product communicates through the RS-232C connectors on the front and rear panels. Connection to the front panel automatically disables the rear port.

PERFORMANCE SPECIFICATIONS

ACCURACIES OF MEASURED CURRENTS

| For 5A CT | For 1A CT | Accuracy |
|-------------|--------------|----------|
| 0.1 to 0.5A | 0.02 to 0.1A | ±5% |
| 0.5 to 2.0A | 0.1 to 0.4A | ±3% |
| 2.0 to 7.5A | 0.4 to 1.5A | ±2% |
| 7.5 to 10A | 1.5 to 2.0A | ±3% |
| 10A and up | 2.0A and up | ±5% |

ACCURACIES OF MEASURED VOLTAGES

| Voltage | Accuracy |
|-----------|-------------|
| 15 to 50 | ±2% or ±.5V |
| 50 to 160 | ±2% |

CALCULATED VALUES AND ACCURACY

Present values: W, Var, VA, pf
 Demand values: A, W, Var, VA
 Accuracy: Less than ±4% for all values
 Demand intervals: 1 to 60 min

DATE AND TIME CLOCK SPECIFICATIONS

Accuracy: 3 seconds per day at 25°C
 Resolution: 10 ms
 Backup battery: Lithium carbon monofluoride
 Battery life: 20 years
 Date and time setting provisions:
 Front panel and communications port

RECOGNITION TIME ON CONTACT INPUTS

8 ms

AC RESPONSE CHARACTERISTICS

50 Hz range is 40 to 55 Hz
 60 Hz range is 50 to 65 Hz
 Rejects harmonics higher than second by 12db or more
 Rejects dc offsets

CHARACTERISTIC CURVES (FOR 51, 51N ELEMENTS)

All time characteristic curves follow the relation:

$$T = \frac{AD}{M^{N-C}} + BD + K$$

| Curve Type | Constants | | | | |
|------------|-----------|--------|------|-------|-------|
| | A | B | C | N | K |
| S | 0.2663 | 0.0339 | 1.00 | 1.297 | 0.028 |
| L | 5.6143 | 2.1859 | 1.00 | 1.000 | 0.028 |
| D | 0.4797 | 0.2136 | 1.00 | 1.563 | 0.028 |
| M | 0.3022 | 0.1284 | 1.00 | 0.500 | 0.028 |
| I | 8.9341 | 0.1797 | 1.00 | 2.094 | 0.028 |
| V | 5.4678 | 0.1081 | 1.00 | 2.047 | 0.028 |
| E | 7.7624 | 0.0276 | 1.00 | 2.094 | 0.028 |
| A | 0.0141 | 0.0000 | 1.00 | 1.000 | 0.028 |
| B | 1.4636 | 0.0000 | 1.00 | 1.047 | 0.028 |
| C | 8.2506 | 0.0000 | 1.00 | 2.047 | 0.028 |
| G | 12.1212 | 0.0000 | 1.00 | 0.020 | 0.028 |
| F | 0.0000 | 1.0000 | 0.00 | 0.000 | 0.000 |

S=Short Inverse I=Inverse B=BS142 Very Inverse
 L=Long Inverse V=Very Inverse C=BS142 Extremely Inverse
 D=Definite Time E=Extremely Inverse G=BS142 Long Time Inverse
 M=Moderately Inverse A=BS142 Standard Inverse F=Fixed Time

Where **D** is the time dial setting (0.0 to 9.9) and **M** is the multiple of pickup. **A, B, C, N** and **K** are constants defining the shape of the curve. The constants have been selected to provide a very close match to the characteristics of electromechanical relays. The constants are provided above for each characteristic curve shape.

Timing accuracy: 5% or 40 ms, whichever is greater for multiples of 2 to 40 times pickup setting.

CURRENT PICKUP FOR PHASE AND NEUTRAL TIME ELEMENTS (51, 51N)

| | FOR 5A CT | FOR 1A CT |
|------------|------------|-------------|
| Range | 0.5 to 12A | 0.1 to 2.4A |
| Increments | 0.1A | 0.02A |

5A pickup accuracy: ±2% or 25 ma
 Dropout/pickup ratio: 95% or higher

FIXED TIME PARAMETERS (FOR 50T, 50TN ELEMENTS)

Characteristic: Fixed time for any current exceeding pickup
 Time range: 40 to 1000 ms
 Time increments: 10 ms
 Reset: Reset is instantaneous
 Timing accuracy: ±5% or 15 ms, whichever is greater

CURRENT PICKUP FOR PHASE AND NEUTRAL FIXED TIME ELEMENTS (50T, 50TN)

| | FOR 5A CT | FOR 1A CT |
|------------|-------------|------------|
| Range | 0.5 to 150A | 0.1 to 30A |
| Increments | 0.1A | 0.02A |

Pickup accuracy: ±5%
 Dropout / Pickup ratio: 90% or higher

PERFORMANCE SPECIFICATIONS (continued)

INSTANTANEOUS RESPONSE CHARACTERISTICS (FOR 50, 50N ELEMENTS)

Characteristic: No intentional delay
Maximum time at 1.05 times pickup: 80 ms
Maximum time at 5.0 times pickup: 30 ms

CURRENT PICKUP FOR PHASE AND NEUTRAL INSTANTANEOUS ELEMENTS (50,50N)

| | FOR 5A CT | FOR 1A CT |
|-----------|------------|-----------|
| Range | .5 to 150A | .1 to 30A |
| Increment | 1A | 0.2A |

Pickup accuracy: $\pm 5\%$
Dropout / Pickup ratio: 90% or higher

UNDERVOLTAGE RESPONSE CHARACTERISTIC (FOR 27 ELEMENTS)

Characteristic: *Definite time*
Time range: 1 to 1000 s
Setting increment: 1 s
Reset: 16 ms or less
Timing accuracy: $\pm 5\%$

UNDERVOLTAGE PICKUP SETTING (27)

Setting range: 50 to 100% of nominal input
Setting increment: 1V
Pickup accuracy: $\pm 2\%$
Dropout / Pickup ratio: 110% or higher

UNDERFREQUENCY RESPONSE CHARACTERISTIC (FOR 81 ELEMENT)

Characteristic: *Definite time*
Time range: 70 to 500 ms
Setting increment: 10 ms
Reset: Two cycles or less
Timing accuracy: 10% or 50 ms,
whichever is greater

UNDERFREQUENCY PICKUP SETTING (81)

Voltage supervision range: 40 to 120v
Setting range: Nominal frequency +5 Hz, -10 Hz
Setting increment: 0.01 Hz
Pickup accuracy: 0.01 Hz

RESTORATION-FREQUENCY RESPONSE CHARACTERISTIC (FOR 81 ELEMENT)

Conditional requirement: Underfrequency trip
has occurred
Characteristic: *Definite time*
Time range: 1 to 1000 s
Time increment: 1 s
Reset: 16 ms or less
Timing accuracy: $\pm 5\%$

RESTORATION-FREQUENCY PICKUP SETTING (81)

Voltage supervision range: 40 to 120V
Setting range: Nominal frequency +5 Hz, -10 Hz
Setting movement: 0.01 Hz
Pickup accuracy: 0.01 Hz

RECLOSING RELAY TIMERS (FOR 79 ELEMENT)

Reclosing delays (4): .04 to 200 s
Reset time range: 1 to 200 s
Maximum cycle time: 1 to 999 s
Fail to reclose timer: 0.1 to 9.9 s

BREAKER FAIL TIMER (FOR 50BF ELEMENT)

Delay range: 30 to 500 ms
Setting increment: 10 ms
Reset time: 16 ms or less

GENERAL SPECIFICATIONS

AC VOLTAGE INPUTS AT 50Hz

Nominal: 100, 173 or 192V phase-to-phase
 Continuous: 133V phase-to-neutral
 One second rating: 260V
 Burden: Less than 1.0 VA at 100V
 phase-to-neutral

AC VOLTAGE INPUTS AT 60Hz

Nominal: 120, 208 or 230V phase-to-phase
 Continuous: 160V phase-to-neutral
 One second rating: 320V
 Burden: Less than 1.0 VA at 120V
 phase-to-neutral

AC CURRENT INPUTS ON UNIT FOR 5A CTs

Continuous: 20A
 One second rating: 500A
 Saturation limit: 250A
 Burden: Less than 1.0 VA

AC CURRENT INPUTS ON UNIT FOR 1A CTs

Continuous: 4A
 One second rating: 100A
 Saturation limit: 50A
 Burden: Less than 1.0 VA

CONTROL POWER

48V, 0.30A, range 35-57 Vdc
 125 Vdc, 0.12A, range 90-150 Vdc
 120 Vac, 0.16A, range 90-132 Vac

TRIP CONTACTS

Make and carry for tripping duty: 30A per
 ANSI C37.90
 Continuous: 7A
 Break resistive or inductive: 0.3A at 250 Vdc

AUXILIARY AND ALARM CONTACTS

Make and carry: 3A
 Break resistive or inductive: 0.3A at 250 Vdc

CONTROL INPUTS

Voltage range: Same as control power
 Nominal current: 15 ma

COMMUNICATION PORTS

RS-232C on front panel for connection to a
 portable terminal
 RS-232C on rear panel for connection to a
 modem

DIELECTRIC STRENGTH

1500 Vac at 50/60 Hz in accordance with
 IEEE C37.90 and IEC 255-5.
 Excludes RS-232C ports.

SURGE WITHSTAND

Qualified to ANSI/IEEE C37.90.1-1989 and
 IEC 255-6

FAST TRANSIENT

Qualified to ANSI/IEEE C37.90.1-1989

IMPULSE

Qualified to ANSI/IEC 255-5

RADIO FREQUENCY INTERFERENCE (RFI)

Type tested using a five watt, hand-held
 transceiver in the ranges of 144 and 440 MHz
 with the antenna placed within six inches of
 the relay

ENVIRONMENT

Operating temperature range: -40° C to 70° C
 (-40° F to 158° F)
 Storage temperature range: -40° C to 70° C
 (-40° F to 158° F)
 Humidity: 95% non-condensing

VIBRATION / SEISMIC

2g at 10 to 500 Hz

SHOCK

15g drop test

WEIGHT

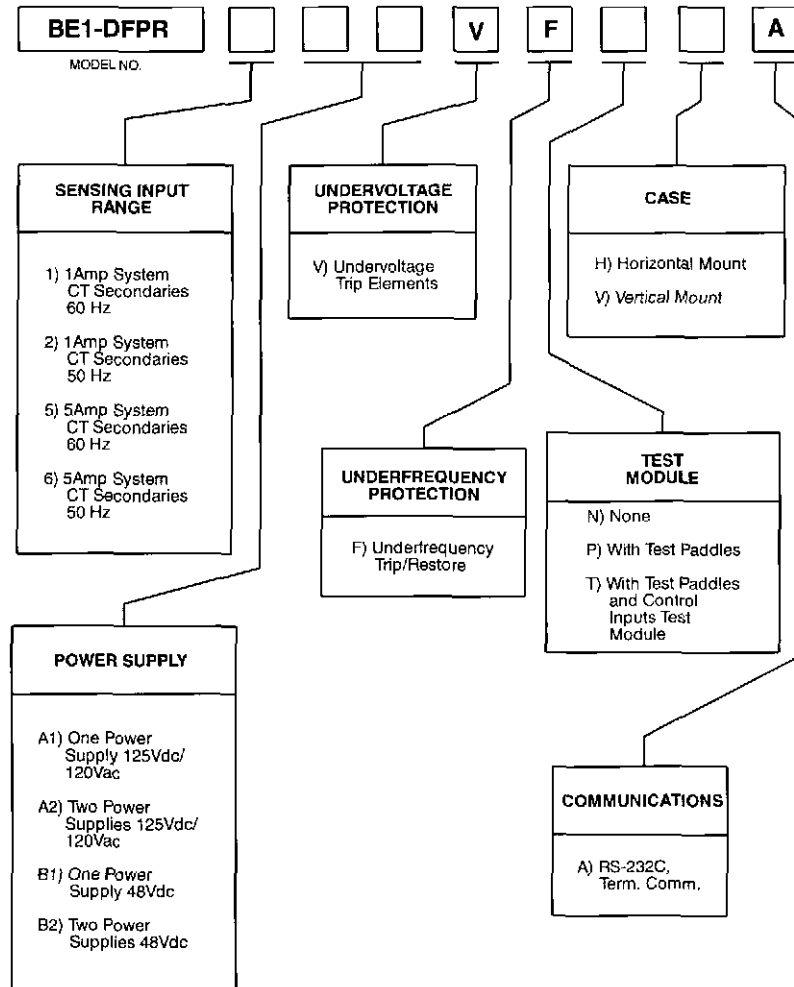
Maximum weight 35 pounds

CASE SIZE

19 inch rack mount
 8.75 inches high (5 rack units)
 8.2 inches deep (behind mounting surface)
 Available for horizontal or vertical mounting

ORDERING

Specify a part number from the chart shown below.



STANDARD ACCESSORIES

A test set is available for providing input power and signals for a full functional test. The test set includes switches to manually activate sensing inputs and indications for trip and close outputs.

The user must fabricate a harness to make connections between the test box and the relay.

The connections to the relay are made using test paddles for current & voltage inputs and trip & close outputs. Tip-plugs are used to connect control inputs to the test points.

To order the test set, specify part number 9-2315-42-100.

Basler Electric