

Multifunction Voltage/Frequency Relay

COOPER Power Systems

Electrical Apparatus

150-20

UFD3 Load Shedding Relay

The UFD3 Load Shedding relay is a member of Cooper Power Systems' Edison® line of protective relays. The UFD3 relay offers the following functions:

- Four over/under definite time frequency elements (81O/U).
- Two definite Hz/second rate of frequency change elements.
- Two voltage elements each configurable as an over- (59), under- (27), or over+under (27+59) elements.
- One Volt/second rate of voltage change element.
- Separate over- element and under- element blocking inputs.

The UFD3 also shares the following features common to all Edison® relays:

- Simple five button man machine interface (MMI) allows access to all functions, settings, and stored data without the need for a computer.
- Bright electroluminescent display easily visible even in brightly lit environments.
- Draw-out design permits relay testing without disturbing connections to case.
- Modbus communication protocol and RS485 terminal on rear.
- Modular design allows the draw-out module to be fitted to a variety of space saving cabinet styles.
- Three programmable Form C (SPDT) output contacts and one Form A/B contact.
- Pick-up (start-time) elements.
- Programmable reset characteristics.
- Dedicated power supply/relay fail output contacts.
- Event records.



Figure 1.
Front View of the UFD3 Load Shed Relay

- Cumulative trip counters.
- Auto-ranging power supplies.

Applications

The UFD3 is ideally suited for use on utility systems that employ load shedding schemes to match load to available generation during system events. The large number of steps available in the UFD3 allows for one relay to control multiple breakers, and to restore load once the system frequency has returned to normal limits.

The UFD3 may also be used in industrial or co-gen environments where the need to shed internal plant load, or to break ties to the supply utility, is required in order to protect local generation or critical processes.

Targets

Eight bright LED targets are provided as follows:

- One red LED for each frequency element.

- One red LED shared by the Volts/second and Hz/second elements.
- One red LED for the voltage (27, 59, 27/59) elements.

For all of the above, the LEDs flash when the element is picked up, and constantly illuminate upon trip. In addition, one yellow LED is provided which illuminates when either of the blocking inputs is active. A second yellow LED flashes when the relay is in programming mode, and illuminates constantly upon relay or power supply failure.

Blocking Inputs

Two blocking inputs are provided. One input is dedicated toward blocking all "under level" functions, and one dedicated to blocking all "over level" functions. While the blocking inputs are active, the tripping of any element associated with the blocking input(s) is prevented. For the "over level" functions, continued sensing of the

input quantities and the countdown of their associated timers continues so that when the blocking is removed, any picked up elements will either trip instantaneously, or after any remaining time delay. For the “under level” functions, sensing of the input quantities are blocked and their associated timers are reset to their initial starting countdown time. Therefore, after the blocking input is removed for the “under level” functions, the “under level” elements must completely time out before producing a trip output signal.

Output Functions

The following list summarizes all of the output functions available which may be assigned to any or all of the programmable output contacts. Note that pick-up and time delayed elements may not be assigned to operate the same output contact(s).

- 1st Frequency Element Pick-up
- 1st Frequency Element Trip
- 2nd Frequency Element Pick-up
- 2nd Frequency Element Trip
- 3rd Frequency Element Pick-up
- 3rd Frequency Element Trip
- 4th Frequency Element Pick-up
- 4th Frequency Element Trip
- 1st Voltage Control Element Pick-up
- 1st Voltage Control Element Trip
- 2nd Voltage Control Element Pick-up
- 2nd Voltage Control Element Trip
- 1st Hz/second Element (instantaneous)
- 2nd Hz/second element (instantaneous)
- Volts/second Element (instantaneous)

TABLE 1
Functional Specifications

| | |
|---|---|
| Nominal Frequency Setting Range | 50 or 60Hz |
| Programmable Φ-Φ primary voltage | 0.10 - 1.00 kV in 0.01kV steps |
| | 1.1 - 9.9 kV in 0.1 kV steps |
| | 1 - 655 kV in 1 kV steps |
| Programmable secondary voltage | 100-125V in 1V steps |
| Frequency Elements | |
| Quantity | 4 |
| Characteristic | Selectable between Under (81<), |
| | Over (81>), Under/Over (81<>), or Disable |
| Δ Frequency setting ¹ (change) | 0.05 - 9.99 Hz in 0.01 Hz steps |
| Time Delay | 0.1 - 9.9 seconds in 0.1 sec. steps |
| Hz/second Elements | |
| Quantity | 2 |
| Hz/second setting | 0.1 - 9.9 Hz/sec in 0.1 Hz/sec steps |
| | or Disable |
| Evaluation time ² setting..... | 2 - 10 cycles in 1 cycle steps |
| Voltage Control Elements | |
| Quantity | 2 |
| Characteristic | Selectable between Under (27), Over (59), |
| | Under/Over (27/59), or Disable |
| Δ Voltage setting ³ | 5 - 90% of system voltage |
| Time Delay | 0.1 - 60.0 seconds in 0.1 sec. steps |
| Volts/second Element | |
| Quantity | 1 |
| Characteristic | Selectable between negative change, |
| | positive change, or absolute change |
| Volts/second setting | 10 - 99 secondary Volts/sec in |
| | 1 Volt/sec steps, or Disable |
| Evaluation time ⁴ setting..... | Fixed at 5 cycles |

¹ The setting is made based upon the change from the programmed system base frequency. Whether a positive, negative, or absolute value change is acted upon is dependent upon the over, under, or over/under setting selected.

² The evaluation time is the time base over which the differential $\frac{df}{dt}$ is evaluated.

³ The setting is made based upon the change from the programmed system base voltage. Whether a positive, negative, or absolute value change is acted upon is dependent upon the over, under, or over/under setting selected.

⁴ The evaluation time is the time base over which the differential $\frac{dV}{dt}$ is evaluated.

Reset Characteristics

Each of the four programmable output relays may be programmed to reset in one of three manners.

- Instantaneously upon the input or calculated quantities dropping below the pickup value.
- Automatically, but with a time delay adjustable between 0.1 and 9.9 seconds in 0.1 second steps.
- Manual reset (by front panel or computer command) only.

Measurements

System frequency, phase-to-phase voltages, and phase-to-neutral volt-ages are available for display on the relay and are accessible by software.

Last Trip Record

The following parameters are stored in non-volatile memory, providing details of the last trip event:

- Which element was the cause of the last trip.
- Frequency, phase-to-phase volt-ages, Hz/sec rates of change as measured by both Hz/sec elements, and the Volt/sec rate of voltage change.

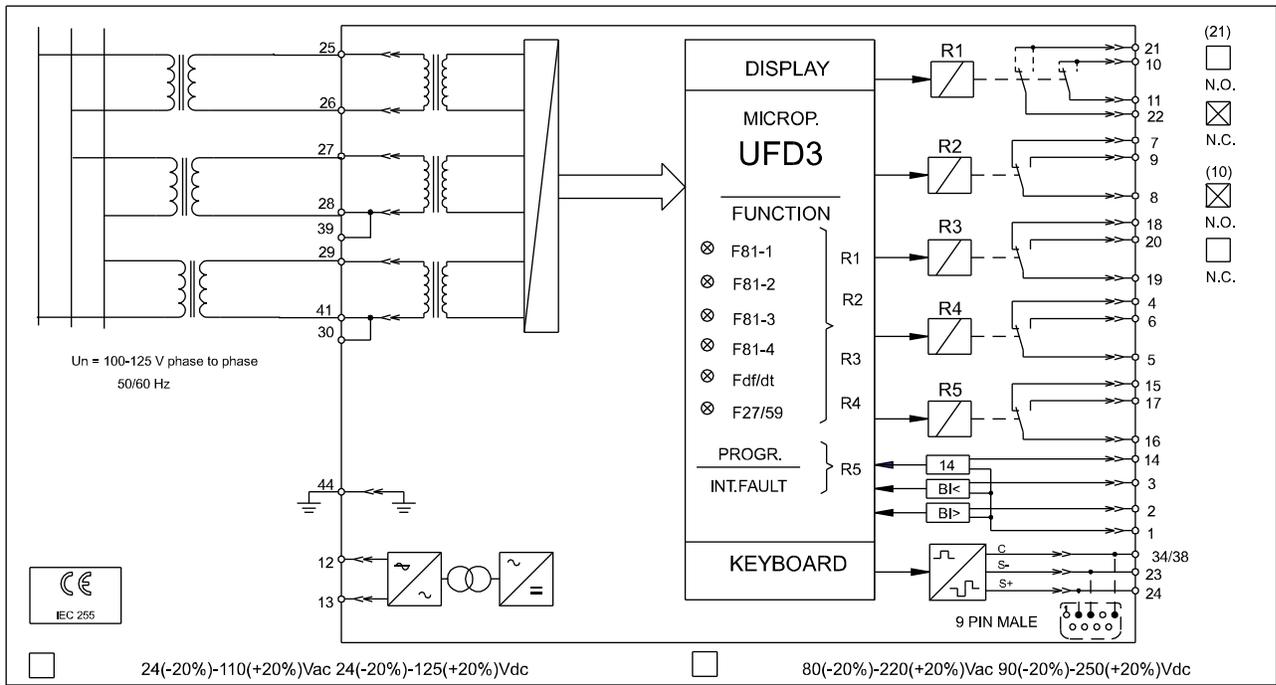


Figure 2
Wiring Diagram for the UFD3 Relay

Diagnostics

Complete memory and circuit diagnostics are run upon powering the relay. The revision level of the firmware is displayed at this time.

During normal operation the relay suspends operation every 15 minutes for 10 msec and runs a comprehensive set of diagnostics that includes memory checksum, test of the A/D converters by injection of an internally generated reference voltage, and a check of the ALU.

The relay provides two manual test routines which may be run at any time. The first routine performs the same 15 minute test in addition checks the target LEDs and the control circuitry to the output relays without operating the output relays. The second test is identical but also operates the output relays.

Dimensions and Electrical Specifications

See Catalog Section 150-05 for electrical specifications and dimensional information on all Edison Relays.

TABLE 2
Catalog Numbers

| Description | Catalog Number |
|---|----------------|
| UFD3 with 24-110V AC-DC supply | UFD3LJ |
| UFD3 with 90-220V AC-DC supply | UFD3HJ |
| To the above add one of the following suffixes to identify the cabinet style | |
| Draw-out relay only, no cabinet supplied | D |
| Single relay case | S |
| Double relay case | T |
| 19" Rack mount cabinet | N |

Ordering Information

The only ordering options for the UFD3 relate to the power supply range desired and the mounting cabinet. See Table 2.

Example: UFD3LJS is an UFD3 with low range power supply in a single relay case.

If ordering two or more relays to be fit in a common case, the first relay ordered should indicate the case style desired. This relay will be located in the leftmost bay of the

case. Subsequent relays should use the C2, C3, or C4 suffixes to denote their position in the case using the leftmost bay as a "C1" reference.

Example: An UFD3xJN and an IM30AExxJC2 consists of an UFD3 relay in the leftmost bay of a 19" rack case, with an IM30AE relay in the second bay from the left. The third and fourth bays will be empty and will be covered with blank faceplates.