Operations Manual

COOPER

Cooper Power Systems

Electrical Apparatus

UFD3 Multifunction Frequency/Voltage Relay

S150-20-1

The Operations Manual is designed to familiarize the reader with how to install, program, and set up the relay for operation. For more detailed information regarding the relay's theory of operation, application notes, internal schematics, service information, etc., please refer to the UFD3 section of the Edison® Relay Technical Reference Manual, bulletin R150-00-1. Contact your local Cooper Power Systems representative for ordering information.

CONTENTS

INTRODUCTION

The UFD3 relay provides all of the frequency-related functions necessary for the protection of a feeder or rotating equipment. Two digital inputs are available to provide selective blocking of various functions. Five output relays are provided, of which four are programmable. All settings, measurements, and programming of the relay is possible through its front panel controls, or by means of a computer connected to the relay's RS485 communications port. The functions provided by the UFD3 are:

- 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) element.
- One Volt/second rate of voltage change element.

The UFD3 offers two programmable inputs, which can serve to block the operation of the over- or under- protective elements.

Separate pickup functions are also provided for all elements (except the Volts/second element) which may be used to operate output relays to in order to implement various control, blocking, logic, or SCADA functions.

HANDLING

As with any piece of electronic equipment, care should be taken when handling the relay, particularly in regards to electrostatic discharge, as the damage may not be immediately obvious. All Edison relays are immune to electrostatic discharge when left in their protective case. However, when the relay is removed from its case, the following practices should be observed.

- Touch the case to ensure that your body and the relay are at the same potential.
- Whenever possible, handle the exposed relay by the front panel, the rear connector, or by the edges of the printed circuit boards. Avoid touching the individual electronic components or the embedded traces on the circuit boards.
- If you must hand the exposed (i.e., drawn-out) relay to another person, make sure you are both at the same electrical potential.
- When setting the drawn-out relay down, make sure the surface is either anti-static in nature or is at the same electrical potential as your body.
- Relays should always be placed in storage in their protective case. If storage of the drawn-out relay outside of its protective case is required, then the exposed relay should be placed in a suitable anti static plastic or foam container.

INSTALLATION

Edison 'M' Series relays are shipped either in single or double width cabinets, or in standard 19" 3U rack mount enclosures capable of housing up to four 'M' Series relays. The double case mounting is similar to the single case, but requires a 235 x 142mm panel opening. The 19" rack mount case is a standard 3U high 19" cabinet. See catalog section 150-00 for cabinet dimensions.

To remove the relay from its case, refer to Figure 1. The relay may be removed from its protective case by turning with a flat bladed screwdriver the locking screws ① and ② on the front panel latches ③ so that the slot on the screw is parallel to the ground. The latches may then be pulled from the inside edge to release the relay. Carefully pull on the latches to remove the relay from the housing.

To re-install the relay in its case, align the printed circuit boards with the guides in the relay case and slide the relay in most of the way. For single and double cases, make sure the locking arm on the back of each of the latches ③ lines up with the locking pins in the case. Then push the latches in, seating the relay. Turn the screws on the latches until the slot is perpendicular to the ground.

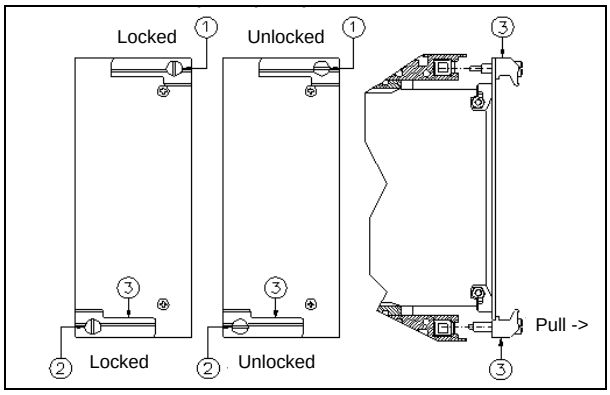


FIGURE 1: LATCH MECHANISM FOR REMOVAL OF RELAY FROM CASE

ELECTRICAL CONNECTIONS

Power is supplied via terminals 12 and 13, with common at terminal 44. Chassis ground is made via the external screw provided on the case. All Series 'M' relays are available with one of two autoranging power supplies. Descriptions of the input voltage ranges are given in Table 1. The input supply voltage is noted on the relay case. In the event the relay is fitted with the incorrect power supply, the power supply boards are easily field replaceable. See Bulletin S150-99-1 for instructions and part numbers.

TABLE 1: POWER SUPPLY INPUT RANGES

Power Supply	DC Voltage Range	AC Voltage Range
L	24V (-20%) to 125V (+20%)	24V (-20%) to 110V (+15%) 50/60 Hz
H	90V (-20%) to 250V (+20%)	80V (-20%) to 220V (+15%) 50/60 Hz

All electrical connections, including the RS485 connections, are made on the back of the relay. See Figure 2. All the terminals will accept up to a No. 6 stud size spade connector (or any type of lug up to 0.25" wide), 12 AWG wire (4 mm²), or FASTON connectors.

Electrical connections must be made in accordance with the relay's wiring diagram found in Figure 3. The numbers next to the circles along the edge of the functional block diagram of the relay indicate the terminal numbers corresponding to the terminal numbers on the back of the relay as shown in Figure 2. The PT inputs must provide the relay with phase-to-phase voltages and be the phase rotation shown.

OUTPUT RELAYS

Output relays 1 through 4 are user programmable to operate in conjunction with the tripping of any protective element or elements. Relay 1 (R1) consists of two isolated SPST (one From A and one Form B) terminals as being either normally open or normally closed. The other three output relays, R2, R3, and R4, all have Form C (i.e., SPDT) contact arrangements.

Output relay 5 is normally energized (shown de-energized) and operates only upon power supply failure or on an internal relay fault.

BLOCKING INPUTS

The UFD3 has two inputs that perform blocking functions. The open circuit voltage across the terminals of these inputs is 15 VDC. The internal resistance is 2.2 k Ω. When the external resistance across these terminals is less than 2.0kΩ, they are considered to be shorted. See Programming the Relay for more information on the function of these inputs.

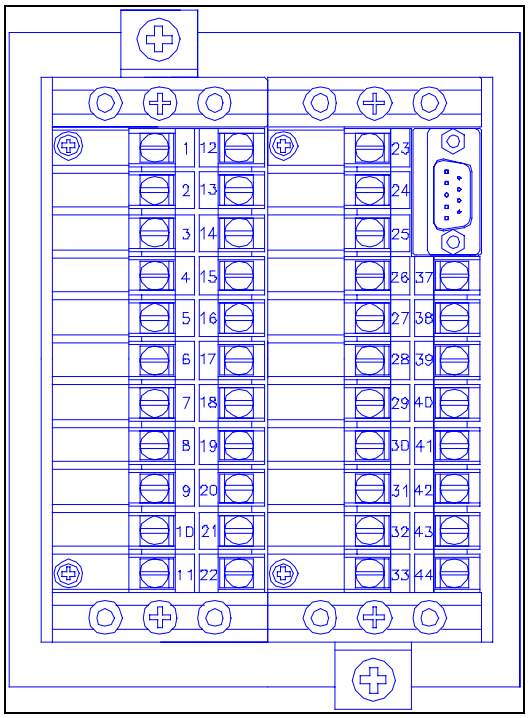


FIGURE 2: VIEW OF REAR TERMINAL CONNECTIONS

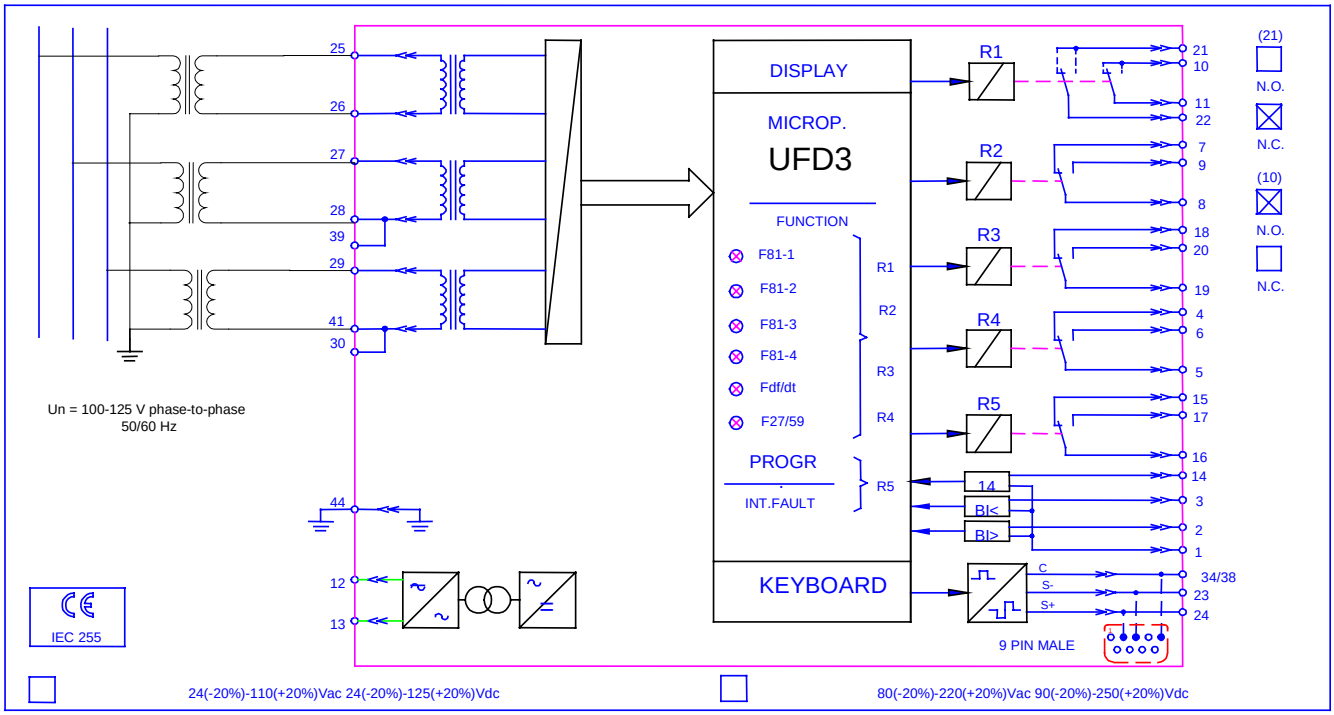


Figure 3 - UFD3 Wiring Diagram

TARGET DESCRIPTION

The front panel of the UFD3 contains eight LEDs, which act as the targets for the relay elements. The top row of four targets corresponds to the four frequency elements, and is marked F1, F2, F3, and F4. As soon as the measured frequency exceeds the trip level defined by the programming variables **fa**, **fb**, **fc**, or **fd** the appropriate LED begins to flash. Once the time delay associated with that element has expired (**tfa**, **tfb**, **tfc**, and **tfd**), the relay will have tripped and the LED goes to a constant ON state.

The two center LEDs on the bottom row are also red. The LED marked df/dt - dV/dt corresponds to the rate of change elements Hz/second and V/second respectively. The LED marked VOLTAGE corresponds to the over/under voltage control elements. As with the frequency LEDs, these LED flash during pick-up and illuminate continuously upon trip.

The left most yellow LED will blink when the relay is in programming mode and will illuminate constantly when an internal relay failure has occurred. The right most yellow LED will flash at any time either of the two blocking inputs is active.

In case of an auxiliary power supply failure the status of the targets is recorded to non-volatile memory. The status of the targets is maintained when auxiliary power is restored.

KEYBOARD OPERATION

All measurements, programmed settings, and recorded data may be accessed through the front panel. The five buttons are color-coded and their sequence of operation is indicated on the front panel by means of arrows directing the user to the next appropriate button to press. Figures 4 and 5 give an overview of the keyboard operation.

PROGRAMMING THE RELAY

The relay may be programmed from the front panel or by external computer control. This section will describe the procedure for setting the relay from the front panel. Consult the program's User's Manual for instructions on programming the relay via software.

Two programming modes are available. The first is the **SETTINGS** mode, where all of the input parameters (e.g., VT ratio, rated frequency) and settings (e.g., time delays, etc.) are set. The second is the **F➔Relay** mode where the various output relays are assigned to the various protective elements. To enter program mode, follow these steps:

1. Press the **MODE** button, to get into **PROGRAM** mode.
2. Press the **SELECT** button to obtain either the **SETTINGS** or **F➔Relay** display.
3. Using a thin tool (e.g., a small screwdriver) press the recessed **PROG** button. The **PROGRAM** LED will now be flashing, indicating that **PROGRAM** mode has been successfully entered.

CHANGING A SETTING

Once in active **PROGRAM SETTINGS** mode, you may now change the relay settings. For instruction on changing the output relay assignments see the section titled Changing Output Relay Assignments. Change the settings as follows:

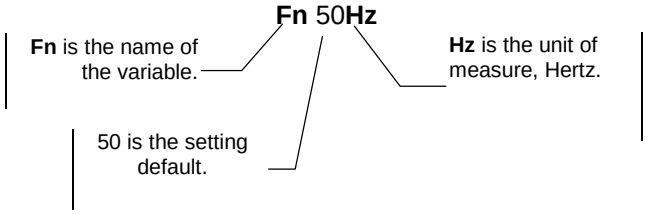
1. Press the **SELECT** button to scroll through the various input parameters available for programming.
2. When the desired parameter to be changed is displayed, press the **+** and **–** buttons to change the displayed value. For numerical values where the range of settings is large, the display may be speeded up by pressing the **SELECT** button at the same time the **+** or **–** is pressed.
3. When the desired value in displayed, press the **ENTER/RESET** button to store the new setting for that parameter.
4. Repeat steps 1-3 for each setting.
5. When finished, press the **MODE** button to leave programming mode and return the relay to normal operation.

DESCRIPTION OF RELAY SETTING VARIABLES

This section describes each variable in the **PROGRAM SETTINGS** mode. The following conventions are used:

- The name of the variable and any unit of measure displayed (Volts, Hz, etc.) is in bold face type. Some variables do not have a unit of measures displayed. An example of these are variables that define curve shapes.
- The default value is shown in regular typeface.

For example:



A value of "Dis" in the Setting range column indicates that when the variable is set to this value, the related function is disabled.

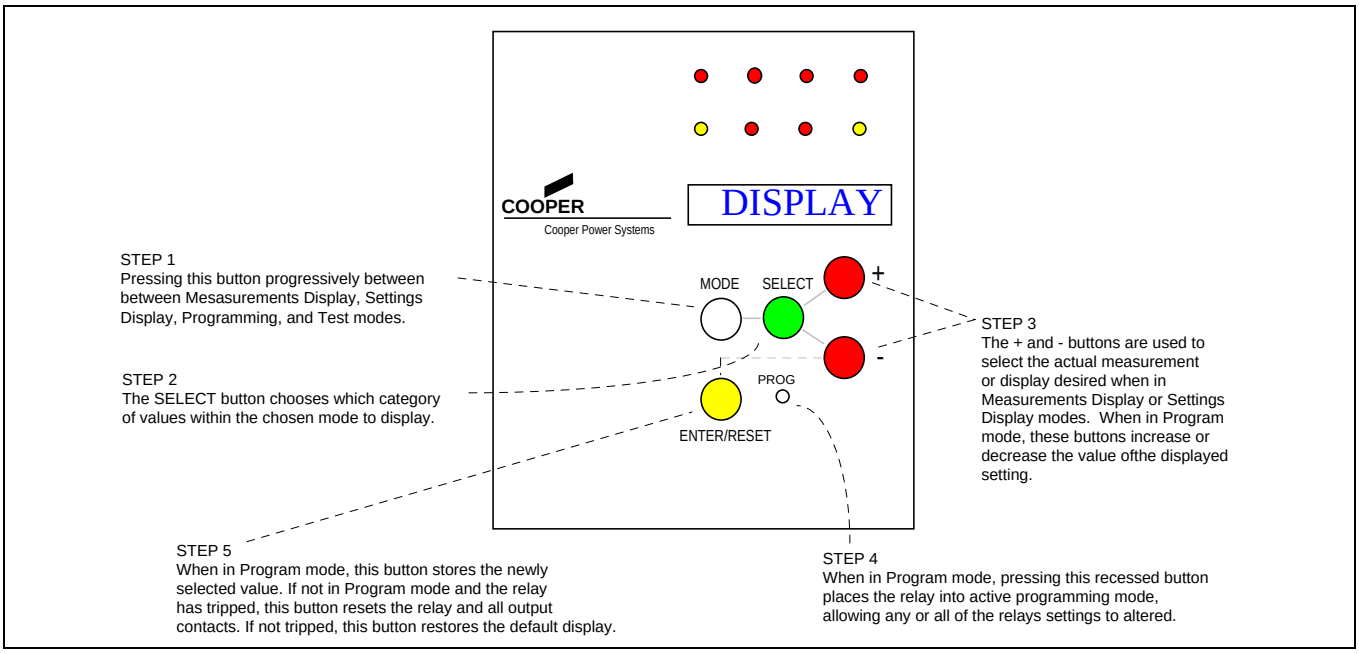


FIGURE 4 - KEYBOARD OPERATION

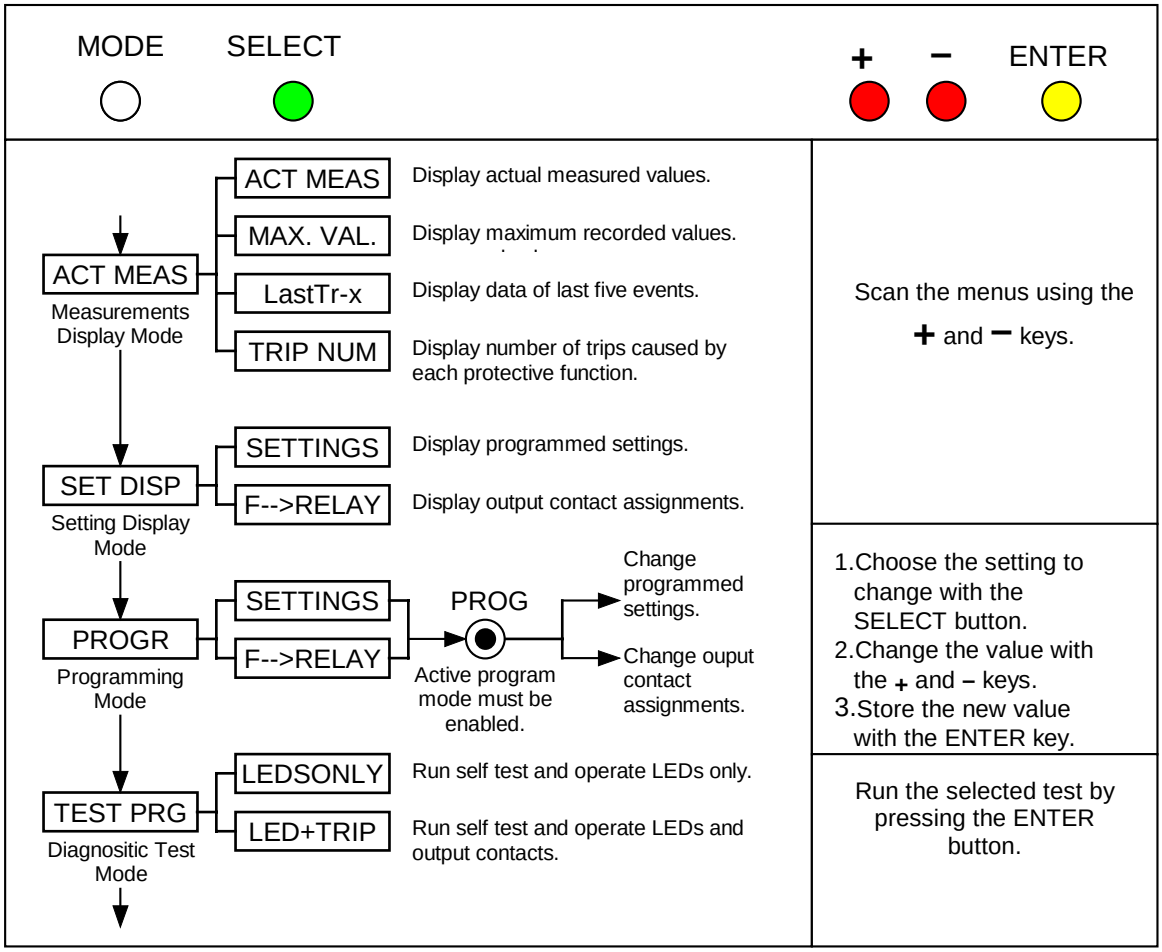


FIGURE 5- WIRING DIAGRAM OF THE UFD3

TABLE 2: PROGRAM SETTING VARIABLES

DISPLAY	DESCRIPTION	SETTING RANGE
Fn 50**Hz**	System frequency	50 or 60 Hz
UnP 10**kV**	Rated primary phase to phase voltage of the system PTs	0.10 to 655 kV. Step size varies: 0.10 to 1.00 kV in 0.01 kV steps 1.1 to 9.9 kV in 0.1 kV steps 10 to 655kV in 1kV steps
UnS 100**V**	Rated secondary voltage of the system PTs	100 to 125 V in 1V steps
Fn -/+ **fa**	Operation mode of the first frequency element, fa	**+** indicates overfrequency operation only; **-** indicates underfrequency operation only; **-/+** indicates under/over frequency operation **Dis** indicates the element is disabled.
fa 0.50 **Hz**	Differential pickup value for the first frequency element, fa.	0.05 to 9.99 Hz in 0.01Hz steps
tfa 1.0**s**	Time delay associated with the trip of the first frequency element	0.1 to 60.0 seconds in 0.1 second steps
Fn - **fb**	Operation mode of the second frequency element, fb	**+** indicates overfrequency operation only; **-** indicates underfrequecny operation only; **-/+** indicates under/over frequency operation **Dis** indicates the element is disabled.
fb 1.00 **Hz**	Differential pickup value for the second frequency element, fb.	0.05 to 9.99 Hz in 0.01Hz steps
tfb 2.0**s**	Time delay associated with the trip of the second frequency element	0.1 to 60.0 seconds in 0.1 second steps
Fn - **fc**	Operation mode of the third frequency element, fc	**+** indicates overfrequency operation only; **-** indicates underfrequecny operation only; **-/+** indicates under/over frequency operation **Dis** indicates the element is disabled.
fc 1.50 **Hz**	Differential pickup value for the third frequency element, fc.	0.05 to 9.99 Hz in 0.01Hz steps
tfc 1.5**s**	Time delay associated with the trip of the third frequency element	0.1 to 60.0 thirds in 0.1 third steps
Fn + **fd**	Operation mode of the fourth frequency element, fd	**+** indicates overfrequency operation only; **-** indicates underfrequecny operation only; **-/+** indicates under/over frequency operation **Dis** indicates the element is disabled.
fd 1.50 **Hz**	Differential pickup value for the fourth frequency element, fd.	0.05 to 9.99 Hz in 0.01Hz steps
tfd 1.5**s**	Time delay associated with the trip of the fourth frequency element	0.1 to 60.0 thirds in 0.1 third steps
1Df -/+	Operation mode of the first Hz/second element	**+** indicates over Hz/second operation only; **-** indicates under Hz/second operation only; **-/+** indicates under/over Hz/second operation **Dis** indicates the element is disabled.
1d0.5**Hz/s**	Pickup value of the first Hz/second element, 1d.	0.1 to 9.9 Hz/seconds in 0.1 Hz/sec steps: **Dis** indicates the element is disabled

DISPLAY	DESCRIPTION	SETTING RANGE
1dt 5**Cy**	Evaluation time[1] of the first Hz/second element	2 to 10 cycles in 1 cycle steps
2Df -/+	Operation mode of the second Hz/second element	**+** indicates over Hz/second operation only; **-** indicates under Hz/second operation only; **-/+** indicates under/over Hz/second operation **Dis** indicates the element is disabled.
2d5.0**Hz/s**	Pickup value of the second Hz/second element, 1d.	0.1 to 9.9 Hz/seconds in 0.1 Hz/sec steps: **Dis** indicates the element is disabled
2dt 10**Cy**	Evaluation time of the second Hz/second element	2 to 10 cycles in 1 cycle steps
Un -/+ **ua**	Operation of the first voltage control element, ua.	**+** indicates overvoltage operation only; **-** indicates undervoltage operation only; **-/+** indicates under/over voltage operation **Dis** indicates the element is disabled.
ua10**%Un**	Pickup differential value of the first voltage control element, ua.	5 to 90% in 1% steps
tua 1.0**s**	Trip time delay of the first voltage control element, ua.	0.1 to 60.0 seconds in 0.1 second steps
Un + **ub**	Operation of the second voltage control element, ub.	**+** indicates overvoltage operation only; **-** indicates undervoltage operation only; **-/+** indicates under/over voltage operation **Dis** indicates the element is disabled.
ub20**%Un**	Pickup differential value of the second voltage control element, ub.	5 to 90% in 1% steps
tub 2.0**s**	Trip time delay of the second voltage control element, ub	0.1 to 60.0 seconds in 0.1 second steps
de 50 **V/s**	Pickup differential value of the Volts/second element. The variation is based on the change over a 5-cycle period[2].	10 to 99 Volts/second in 1 V/second steps **Dis** indicates the element is disabled.
de/dt +/-	Operation mode of the Volts/second element.	+ indicates operation only for increases in Voltage over time; - indicates operation only for decreases in Voltage over time; +/- indicates operation for magnitude of change only.
NodAd 1	Identification number of relay when connected on a serial communication bus.	1 to 250 in steps of 1

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

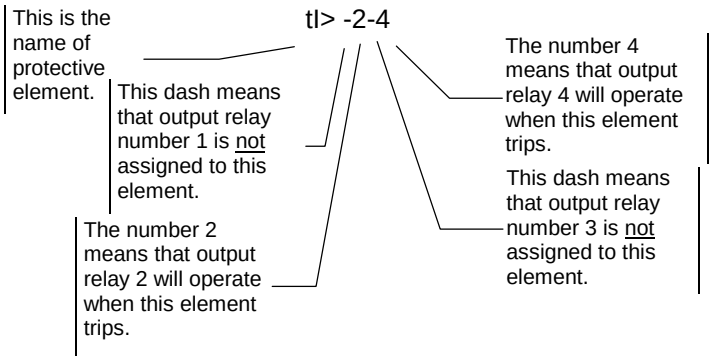
[2] The evaluation time of 5 cycles is the time base over which the differential $\frac{dV}{dt}$ is evaluated.

CHANGING OUTPUT RELAY ASSIGNMENTS

Output relays R1 through R4 may be assigned to any protective element, or any combination of elements. The only exception is that the relay cannot be assigned to both pick-up (start-time) elements, and time dependent protective elements.

1. First, enter the **F➔Relay** program mode.
2. Press the SELECT button to display the protective element for which the relay assignments are to be made or changed.
3. Press the + key to select the output relay. Each press of the + key selects the next output relay. Once selected, the relay position blinks.
4. Press the - key to toggle whether the element is assigned to the output relay or not. If assigned, the output relay number appears. If not, only a hyphen (-) will be displayed.
5. Press the ENTER/RESET button to store the changes.
6. Repeat steps 1 through 5 for each protective element whose assignments you desire to change.

For example:



DESCRIPTION OF OUTPUT RELAY VARIABLES

This section describes each variable in the **PROGRAM, F➔Relay** mode. The following conventions are used:

- The name of the variable is in bold face type.
- The default output relay settings are shown in regular typeface.

TABLE 3 - OUTPUT RELAY PROGRAMMING DISPLAY DEFINITIONS

DISPLAY	DESCRIPTION
fa **---4**	Pick-up (or start-time) element associated with the first frequency element, fa. NOTE: A time delay of approximately 80msec is associated
tfa 1---	Time delayed element associated with the first frequency element, fa.
fb ---4	Pick-up element associated with the second frequency element, fb. See NOTE for **fa**.
tfb 1---	Time delayed element associated with the second frequency element, fb.
fc ---4	Pick-up element associated with the third frequency element, fc. See NOTE for **fa**.
tfc 1---	Time delayed element associated with the third frequency element, fc.
fd ---4	Pick-up element associated with the fourth frequency element, fd. See NOTE for **fa**.
tfd 1---	Time delayed element associated with the fourth frequency element, fd.
1d --3-	Instantaneous element associated with the first Hz/second element, **1d**.
2d --3-	Instantaneous element associated with the second Hz/second element, **2d**.
ua ---4	Pick-up element associated with the first voltage control element, **ua**.
tua -2--	Time delayed element associated with the first voltage control element, **ua**.
ub ---4	Pick-up element associated with the second voltage control element, **ub**.
tub -2--	Time delayed element associated with the second voltage control element, **ub**.
de **----**	Instantaneous element associated with the Volts/second control element.
R1tr3.0**s**	Reset mode for all elements associated with output relay 1. Reset may be programmed to take in one of three manners: 1. Instantaneously upon the input or calculated quantities dropping below the pickup value. This is signified by **Aut** in the display. 2. Automatically, but with a time delay adjustable between 0.1 and 9.9 seconds in 0.1 second steps. (Default is this mode with a 3-sec delay). 3. Manual reset (by front panel or computer command) only. This is signified by **Man** in the display.

DISPLAY	DESCRIPTION
R2tr Aut	Same as for R1tr but for output relay 2 assigned functions.
R3tr Aut	Same as for R1tr but for output relay 3 assigned functions.
R4tr Aut	Same as for R1tr but for output relay 4 assigned functions.

BLOCKING VARIABLES

Two blocking inputs are provided. One input is dedicated toward blocking all "under level" functions, and one dedicated to blocking all "over level" functions as follows:

Blocking input **BI>**: This blocking input is activated by shorting terminals 1 and 2. The operation of any output relay controlled by an "over level" function is inhibited for as long as the input terminal pair is shorted. This includes any over-frequency, over-voltage, and over-Volts/second elements, as well as the Hz/second elements, which is inherently an "over" function.

Blocking input **BI<**: This blocking input is activated by shorting terminals 1 and 3. The operation of any output relay controlled by an "under level" function is inhibited for as long as the input terminal pair is shorted. This includes any under-frequency, under-voltage, or under-Volts/second elements.

While the blocking inputs are active (i.e., shorted), operation of any element associated with the blocking input(s) is prevented. Operation of the associated timers is blocked as well. The timers reset when the associated blocking input is activated.

PROGRAMMING VIA SOFTWARE

The UFD3 may also be programmed using any of the programming interface software packages provided by Cooper Power Systems or others. Please consult the users manual for the appropriate software.

The UFD3 uses the Modbus© communication protocol. For details on the memory map used in the UFD3 in order to interface it with other Modbus programs or devices, consult the Edison 'M' Series Relay Technical Reference Manual.

RUNNING THE TEST PROGRAMS

If desired, the start up diagnostic routines may be run at any time by accessing the **TEST PRG** mode. Two tests may be run, both of which are identical except for the effect on the output relays.

1. Press the Mode button until **TEST PRG** is displayed.
2. Select the test to run by pressing the **SELECT** button once to show **LEDSONLY**, or twice to display **LED+TRIP**.
   A. If the **LEDSONLY** test is selected, pressing the **ENTER/RESET** button will run the test. All the LEDs should illuminate during the duration of the test. If any error is found, an error code will be displayed and the **RELAY FAIL** light will remain illuminated. The test lasts approximately five seconds. No output relays will be operated or will change status.
   B. If the **LED+TRIP** test is selected, pressing the **ENTER/RESET** button will then display **TestRun?.** To run the test the **ENTER/RESET** button must be pressed again. At this point the test will run and all of the output relays will also be operated. The test lasts approximately five seconds.

⚠ CAUTION

Running the **LED+TRIP** test will operate all of the output relays. Care must be taken to ensure that no unexpected or harmful equipment operations will occur as a result of running this test. It is generally recommended that this test be run only when all dangerous output connections are removed.

These test routines may also be initiated by an external computer running the appropriate software.

REAL TIME MEASUREMENTS

To display the real-time measured values of the relayed quantities, enter the ACT MEAS mode of operation as follows:

1. Press the **MODE** button, to get into **MEASURES** mode.
2. Press the **SELECT** button to select the ACT MEAS mode.
3. Press the + or – buttons to scroll through the available measurements. The data available is summarized in Table 4.

TABLE 4 - AVAILABLE METERED VALUES IN "ACT MEAS" MODE

DISPLAY	MEASURED QUANTITY
F	System frequency
Ua	Phase A - B voltage
Ub	Phase B - C voltage
Uc	Phase C - A Voltage
Ea	Phase A - neutral voltage
Eb	Phase B - neutral voltage
Ec	Phase C - neutral voltage

LAST EVENT DATA

The relay stores all information associated with the last trip event. To access this data, enter the LASTTRIP mode of operation as follows:

1. Press the **MODE** button, to get into **MEASURES** mode.
2. Press the **SELECT** button to select the LASTTRIP mode.
3. Press the + or – buttons to scroll through the event record. The data available is summarized in Table 5.

TABLE 5 - AVAILABLE LAST EVENT DATA IN "LASTTRIP" MODE

DISPLAY	HISTORICAL QUANTITY
Cau:xxxx	"xxxx" is the element which caused the last trip operation as follows: fa 1st frequency element fb 2nd frequency element fc 3rd frequency element fd 4th frequency element 1d 1st Hz/second element 2d 2nd Hz/second element ua 1st voltage element ub 2d voltage element de Volts/second element
F	Frequency at time of trip
Ua	Phase A - B voltage at time of trip
Ub	Phase B - C voltage at time of trip
Uc	Phase C - A Voltage at time of trip
1Hz/s	Value of the 1st Hz/sec element at time of trip
2Hz/s	Value of the 2nd Hz/sec element at time of trip
V/s	Value of the Volts/sec element at time of trip

CUMULATIVE TRIP COUNTERS

To display w many times the relay has tripped for each of the protective elements, enter the TRIP NUM mode of operation as follows:

1. Press the **MODE** button, to get into **MEASURES** mode.
2. Press the **SELECT** button to select the TRIP NUM mode.
3. Press the + or – buttons to scroll through the available measurements. The data available is summarized in Table 6.

TABLE 6 - CUMULATIVE TRIP COUNTER DATA IN "TRIP NUM" MODE

DISPLAY	NUMBER OF TRIPS DUE TO...
fa xxxxx	1st frequency element
fb xxxxx	2nd frequency element
fc xxxxx	3rd frequency element
fd xxxxx	4th frequency element
1d xxxxx	1st Hz/second element
2d xxxxx	2nd Hz/second element
ua xxxxx	1st voltage element
ub xxxxx	2d voltage element
de xxxxx	Volts/second element

SPECIFICATIONS

Operating Temperature Range	-20 to +60°C at 95% humidity
Storage Temperature	-30 to +80°C
Rated Input Voltage	125V
Voltage Circuits Overload	2.0 pu Continuous
Burden on Voltage Inputs	0.2 VA at rated voltage
Dielectric test Voltage	2000V, 50/60Hz, 1 minute
Impulse Test Voltage	5kV common mode, 1 kV differential mode, 1.2 x 50 µsec wave
Immunity to high frequency burst	1 kV common mode, 0.5 kV differential mode at 100 kHz, 2.5 kV common mode, 1 kV differential mode at 1 MHz
Immunity to electrostatic discharge	15 kV
Immunity to Sinusoidal Wave Burst	100V over 10 - 1000kHz range
Immunity to radiated electromagnetic field	10V/m over 20 - 1000MHz range
Immunity to High Energy Burst	4 kV common mode, 2V differential mode
Immunity to 50/60Hz magnetic field	1000 A/m
Immunity to impulse magnetic field	1000 A/m 8 x 20 µs
Immunity to magnetic burst	100 A/m over 100 - 1000kHz range
Resistance to vibration	1g from 10 -500 Hz
Rear Connection Terminals	Up to 12AWG (4mm²) stranded wire Lugs up to 0.25 inch (6.5mm) wide, or FASTON connectors
Output Contacts	rated current 5 A rated voltage 380 V nominal switching power with AC resistive load 1100W(380V max.) breaking capacity at 110 VDC: 0.3A with L/R=40ms for 100,000 operations make and carry capacity for 0.5 sec = 30 A (peak) mechanical life over 2,000,000 (2×10^6) operations
PC Board Connectors	Gold plated, 10A continuous, 200A 1 sec.
Power Supply Input Voltage Range:	Two Available at 24 - 110 V AC-DC ± 20% or 90 - 220 V AC-DC; ± 20%
Average Power Supply consumption	8.5 VA
Weight (in single relay case)	2.3kg (5.0lbs)

SETTINGS SHEET FOR UFD3 RELAY - PAGE 1 OF 3

VARIABLE	FACTORY DEFAULT	UNITS	DESCRIPTION	VARIABLE	SETTING	UNITS
Fn	50	Hz	System Frequency	Fn		Hz
UnP	10kV	Primary Volts or kV	Phase VT rated primary line-to-line voltage	UnP		Volts
UnS	100	Volts	Rated VT secondary line-to-line voltage	UnS		Volts
Fn	-/+	---	Operation mode of first frequency element, fa	Fn		-, +, -/+, Dis
fa	0.50	Hz	Differential sensing level of first frequency element, fa	fa		Hz
tfa	1.0	seconds	Trip time delay of first frequency element, fa	tfa		seconds
Fn	-	---	Operation mode of second frequency element, fb	Fn		-, +, -/+, Dis
fb	1.00	Hz	Differential sensing level of second frequency element, fb	fb		Hz
tfb	2.0	seconds	Trip time delay of second frequency element, fb	tfb		seconds
Fn	-	---	Operation mode of third frequency element, fc	Fn		-, +, -/+, Dis
fc	1.50	Hz	Differential sensing level of third frequency element, fc	fc		Hz
tfc	1.5	seconds	Trip time delay of third frequency element, fc	tfc		seconds
Fn	+	---	Operation mode of fourth frequency element, fd	Fn		-, +, -/+, Dis
fd	1.50	Hz	Differential sensing level of fourth frequency element, fd	fd		Hz
tfd	1.5	seconds	Trip time delay of fourth frequency element, fd	tfd		seconds
1Df	-/+	---	Operation mode of the first Hz/second element	1Df		-, +, -/+, Dis
1d	0.5	Hz/sec	Setting of first Hz/second element	1d		Hz/sec
1dt	5	cycle	Evaluation time of first Hz/sec element	1dt		cycles
2Df	-/+	---	Operation mode of the second Hz/second element	2Df		-, +, -/+, Dis
2d	1.5	Hz/sec	Setting of second Hz/second element	2d		Hz/sec
2dt	10	Hz/cycle	Evaluation time of second Hz/second element	2dt		cycles
Un	-/+	ua	Operation Mode of first voltage control element	Un		ua
ua	10	% Rated Voltage	Differential sensing level of first voltage control element	ua		Un
tua	1.0	seconds	Trip time delay of first voltage element	tua		seconds

SETTINGS SHEET FOR UFD3 RELAY - PAGE 2 OF 3

VARIABLE	FACTORY DEFAULT	UNITS	DESCRIPTION	VARIABLE	SETTING	UNITS
Un	+	ub	Operation Mode of second voltage control element	Un		ub
ub	20	% rated voltage	Differential sensing level of second voltage control element	ub		% rated voltage
tub	2.0	seconds	Trip time delay of second voltage element	tub		seconds
de	50	V/sec	Trip level of the volts/second element	de		V/sec
de/dt	-/+	None	Operation mode of the volts/second element	de/dt		None
NodAd	1	None	Modbus Communication Address	NodAd		None

SETTINGS SHEET FOR UFD3 RELAY - PAGE 3 OF 3

Output Relay Programming Assignments (Accessible via the F➔RELAY program mode.)						
VARIABLE	**FACTORY DEFAULT**	**UNITS**	**DESCRIPTION**	**VARIABLE**	**SETTING**	**UNITS**
fa	- - - 4	Outputs	First frequency element pick-up	fa		Outputs
tfa	1 - - -	Outputs	First frequency element time delayed trip	tfa		Outputs
fb	- - - 4	Outputs	Second frequency element pick-up	fb		Outputs
tfb	1 - - -	Outputs	Second frequency element time delayed trip	tfb		Outputs
fc	- - - 4	Outputs	Third frequency element pick-up	fc		Outputs
tfc	1 - - -	Outputs	Third frequency element time delayed trip	tfc		Outputs
fd	- - - 4	Outputs	Fourth frequency element pick-up	fd		Outputs
tfd	1 - - -	Outputs	Fourth frequency element time delayed trip	tfc		Outputs
1d	- - 3 -		First Hz/sec element Instantaneous	1d		
2d	- - 3 -		Second Hz/sec element instantaneous	2d		
ua	- - - 4		First voltage control element pick-up	ua		
tua	- 2 - -		First voltage control element time delayed trip	tua		
ub	- - - 4		Second voltage control element pick-up	ub		
tub	- 2 - -		Second voltage control element time delayed trip	tub		
de	- - - -		Volts/second element instantaneous	de		
R1tr	3.0	seconds	Reset characteristic of output relay R1	R1tr		seconds, Manual, or Auto
R2tr	Aut.	Auto	Reset characteristic of output relay R2	R2tr		seconds, Manual, or Auto
R3tr	Man	Manual	Reset characteristic of output relay R3	R3tr		seconds, Manual, or Auto
R4tr	Aut.	Auto	Reset characteristic of output relay R4	R4tr		seconds, Manual, or Auto

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