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INSTRUCTIONS

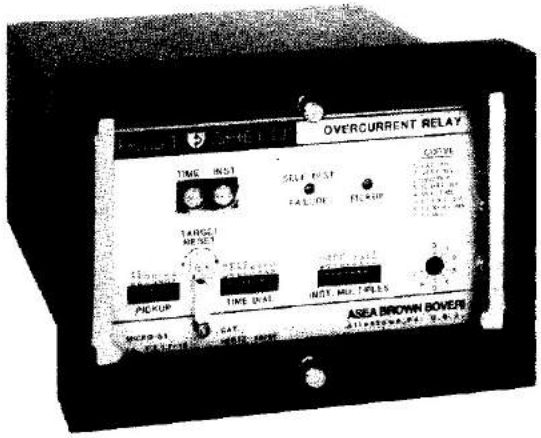
Single-Phase Overcurrent Relay

MICROPROCESSOR-BASED OVERCURRENT RELAY

Micro-51	Catalog Series 446S
Micro-51/FT	Catalog Series 446F



Micro-51/FT



Micro-51

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INTRODUCTION

These instructions contain the information required to properly install, operate, and test the self-powered microprocessor-based single-phase time-overcurrent relay, Type Micro-51 and Type Micro-51/FT, catalog series 446.

The 446S series relay, Type Micro-51 in the Circuit-Shield™ case is suitable for conventional semiflush panel mounting, and provides totally drawout construction with integral test facilities for bench testing. Current transformer shorting is accomplished by a direct-acting spring and blade assembly upon removal of the relay from its case. Sequenced disconnects prevent nuisance tripping during withdrawal or insertion of the relay.

The 446F series relay, Type Micro-51/FT in the Flexitest™ case is suitable for semiflush or projection mounting. The FT-11 case provides total drawout construction with ct secondary shorting, and integral FT knife-blade switches which allow the relay to be tested in place on the panel.

Most user adjustments are located on the front panel behind a clear cover. Target indicators are also mounted on the front panel and are reset by means of a magnet operating assembly which extends through the cover.

PRECAUTIONS

The following precautions should be observed when applying these relays:

1. Incorrect wiring may result in damage. Be sure wiring agrees with the connection diagram for the particular relay before the relay is energized.

2. The entire circuit assembly of the relay is removable from its case. The unit should insert smoothly. Do not use excessive force.

3. High voltage insulation tests are not recommended. If a control wiring insulation test is required, withdraw the unit from its case before applying the test voltage.

4. Note that a setting of 0 (all switches down) on the instantaneous pickup switches disables the instantaneous element.

5. An internal link is provided to set the relay for the system frequency. Be sure to inspect the positioning of this link before placing the relay into service.

6. For units with the optional torque-control feature, the controlling input must be energized with dc control voltage of the proper rating to obtain relay operation.

6. When testing, be sure to interrupt test current immediately upon relay operation.

7. Follow test instructions to verify that the relay is in proper working order.

CAUTION: *since testing and troubleshooting entails working with energized equipment, care should be taken to avoid personal shock. Only competant technicians familiar with good safety practices should service these devices.*

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify Asea Brown Boveri. Use normal care in handling to avoid mechanical damage. Keep the relay clean and dry.

2. INSTALLATION

Mounting and Connections:

The outline dimensions and panel drilling are given in Figure 1. The Circuit-Shield case is shown in Figure 1a, and the Flexitest case in Figure 1b.

Internal connections and typical external connections are shown in Figures 2 and 3. Note the differences in terminal numbers between the Circuit-Shield and Flexitest models.

The Circuit-Shield version of the Micro-51 relay has a metal front panel which is connected through the printed circuit board and connector wiring to the rear terminal marked "G". This terminal should be wired to ground.

The FT-11 case, Micro-51/FT relay, may be semi-flush mounted by means of the four mounting holes on the flanges; or, projection mounted by means of the rear mounting studs. Either a mounting stud or the mounting screws may be used for grounding the relay. The electrical connections may be made directly to the terminals by means of screws when semi-flush mounted, or with the terminal studs furnished for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench. For detailed FT case information refer to I.L.41-076.

Torque-control relays: Micro-51 relays with the "torque-control" option are shown in internal connection diagrams 16D446B and 16D446C. Refer to the listing of common catalog numbers for the appropriate diagram. Important: These relays will be operative only when the dc control voltage is applied to the torque-control input terminals in the proper polarity. With no voltage applied, operation is defeated.

3. SETTINGS

Pickup Current:
The Time-Pickup setting is made by selecting a combination of on/off switches. The time-pickup may be set from 1.5 to 12 amperes, in 0.25 ampere increments (high range units); or, 0.3 to 2.4 amps in 0.05 amp increments (low range units). The setting is the summation of the value of the switches set to the "ON" or "up" position.

For example, for a high range unit, to set a time pickup of 7.75 amps, switches with the following values would be "on", and all others "off": 5 + 2 + 0.5 + 0.25 = 7.75.

If all switches are in the off position the setting defaults to the lowest value of the range for that relay. If the summation of switches in the "on" position exceeds the upper value of the relay's pickup tap range, the setting defaults to that upper limit.

Time Curve:
The time curve is selected by means of the rotary selection switch on the right side of the panel. A small screwdriver must be used to rotate the switch. The codes for Time Curve selection are:

0 = Extremely Inverse	3 = Short Time	5 = Long Time, Extremely Inverse
1 = Very Inverse	4 = Definite Time	6 = Long Time, Very Inverse
2 = Inverse		7 = Long Time, Inverse

Dial positions 8 and 9 are not used, and default to Extremely Inverse.

Time Dial:
The Time Dial setting is made by selecting a combination of on/off switches. The time dial may be set from 1 to 10, in 0.1 increments. The setting is the summation of the value of the switches set to the "ON" or "up" position.

For example, to set a time dial of 4.6, switches with the following values would be "on", and all others "off": 2 + 2 + 0.5 + 0.1 = time dial 4.6.

If all switches are in the off position the setting defaults to a value of 1.0. If the summation of switches exceeds 10.0, the setting defaults to 10.0.

Instantaneous Pickup: the Instantaneous setting is made by selecting a combination of on/off switches. The pickup may be set from 1 to 20 multiples of the time-pickup setting, in 0.1 increments. The setting is the summation of the value of the switches set to the "ON" or up position.

For example, to set an instantaneous pickup of 8.5 multiples, switches with the following values would be "on", and all others off: 5.0 + 2.0 + 1.0 + 0.5 = 8.5x. If the time-pickup were set to 7.75 amperes, the instantaneous pickup would be equal to: 8.5 x 7.75 = 65.9 amperes.

Disabling the instantaneous element: if all instantaneous pickup switches are set in the "off" position the instantaneous element is disabled and will not operate. A setting greater than zero but less than 1.0 will default to 1.0 multiples. A setting greater than 20 will default to 20 multiples.

Operating Frequency Selector Link (Internal): An internal link is provided to set the relay for the system frequency. Be sure to withdraw the relay from its case and inspect the printed circuit board for the proper positioning of this link before placing the relay into service. Refer to the typical printed ciruit board layouts shown later in this book.

4. INDICATORS

Targets: Operation targets are provided for the TIME and INST functions. These targets are actuated by the flow of trip circuit current to the trip coil of the circuit breaker or lockout relay. Standard relays require a minimum trip circuit current of 1 ampere to insure target operation. Relays with the catalog number suffix "-ST" have more sensitive targets that require 0.25A to set. On Circuit-Shield models the targets are manually reset by rotating the swinging magnet on the front cover. On FT models the targets are reset by operating the push rod.

Pickup: A yellow light emitting diode (led) indicator is provided to assist in testing. The led lights when the input current exceeds the TIME pickup value. Some blinking may occur near the pickup value. The pickup point should be considered to be at the value where the indicator is on steadily.

Self-Check Failure: A red led indicator lights when the relay's self-diagnostics detect incorrect performance of the relay's internal circuitry. In order for the self-diagnostics to be running, the input current to the relay must be above approxmately 1 ampere on high range units, and above approximately 0.2 ampere for low range units. If the self-diagnostics program detects a serious problem in the RAM, ROM, or EEPROM, relay operation is prevented.

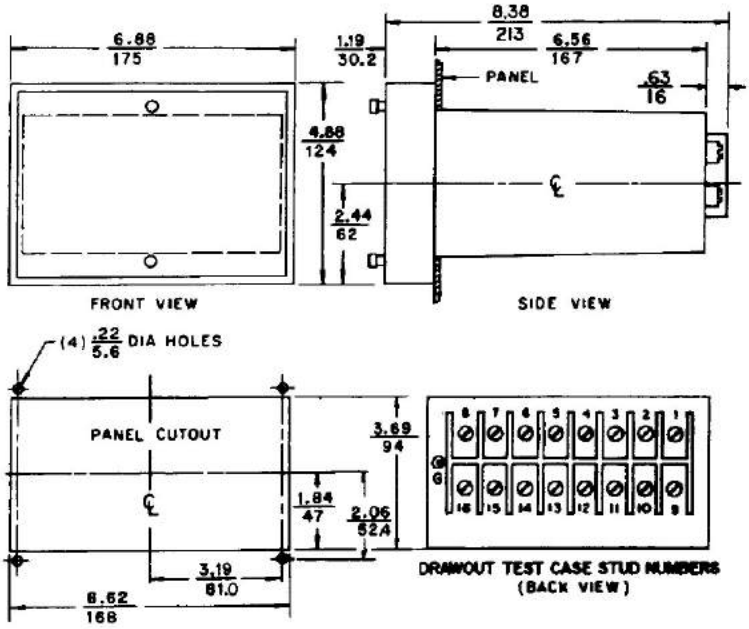
SUMMARY OF COMMON CATALOG NUMBERS

Standard Units	Time-Pickup Range		Internal Connections	Catalog Numbers
Circuit-Shield	1.5 - 12 A		16D446A	446S1201
Circuit-Shield	0.3 -2.4 A		16D446A	446S1101
Flexitest	1.5 - 12 A		10F446A	446F1201
Flexitest	0.3 -2.4 A		10F446A	446F1101
Torque-Control Units	**Time-Pickup Range**	**Control Voltage**	**Internal Connections**	**Catalog Numbers**
Circuit-Shield	1.5 - 12 A	125 vdc	16D446B	446S1241
		110 vdc	16D446B	446S1271
		48 vdc	16D446B	446S1231
		24 vdc	16D446C	446S1291
Circuit-Shield	0.3 -2.4 A	125 vdc	16D446B	446S1141
		110 vdc	16D446B	446S1171
		48 vdc	16D446B	446S1131
		24 vdc	16D446C	446S1191

Figure 1a:

Relay Outline &
Panel Drilling

Circuit-Shield Case



Dimensions are

Inches
mm

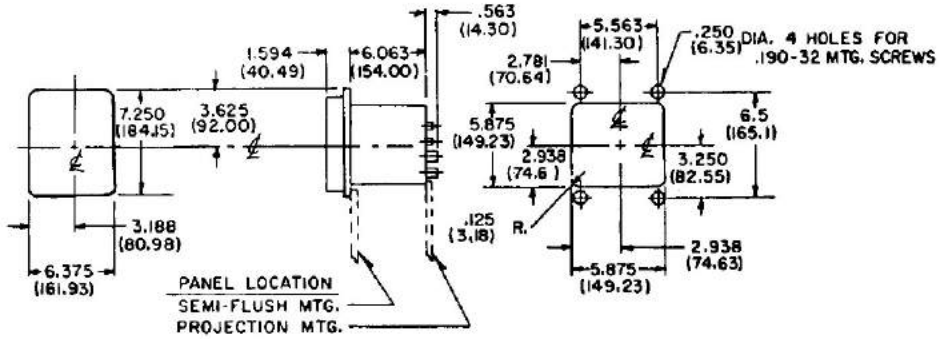
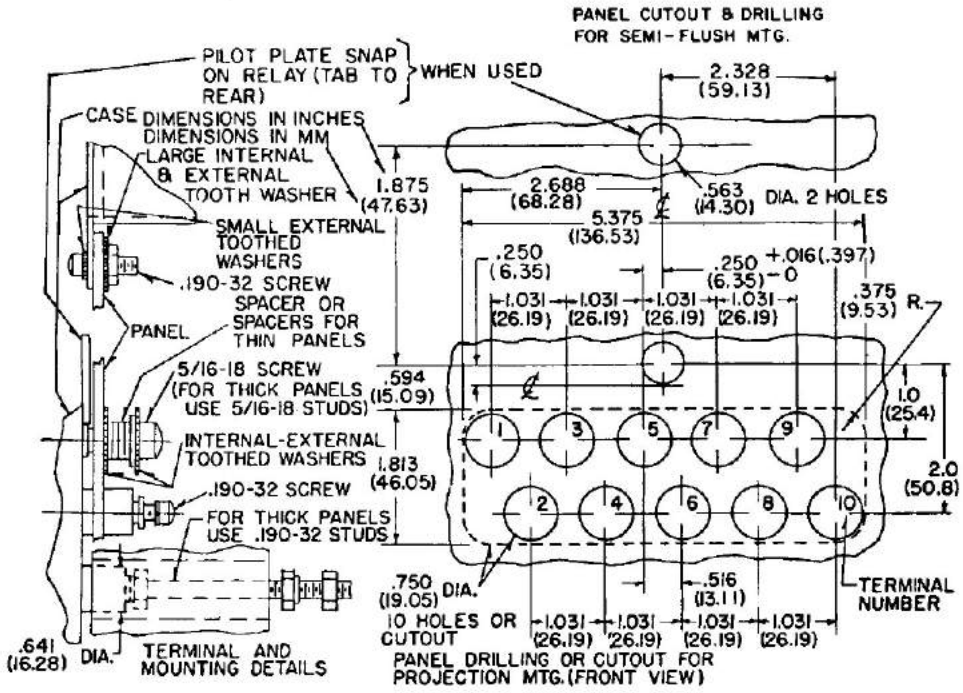


Figure 1b:

Relay Outline &
Panel Drilling

FT-11 Case



APPLICATION DATA

The Micro-51 and Micro-51/FT series 446 single-phase microprocessor based Time-Overcurrent Relays provide phase-to-phase or phase-to-ground overcurrent protection for virtually any type of load circuit. Eight built-in time-overcurrent characteristic curves and wide tap ranges with excellent setting resolution allow great flexibility in the application of the relay. Pickup tap ranges of 1.5-12 amperes and 0.3-2.4 amperes are offered; therefore, the Micro-51 is suitable for applications employing 5 ampere ct's and in many cases, also with 1 ampere ct's.

The Micro-51 has, built-in, eight different time-current curve families: Inverse, Very Inverse, Extremely Inverse, Definite Time, Short Time, Long Time Inverse, Long Time Very Inverse, Long Time Extremely Inverse. Refer to the time current curves that follow for these characteristics. Transparent curves are available on request to the factory.

The standard Micro-51 relay is completely self-powered from the current being measured, therefore, no standby dc control power is required from the station battery. The Micro-51 relay is also suitable for use on capacitor trip arrangements, where the nominal capacitor voltage does not exceed 280 vdc. The burden data for the relay is given in Figure 5. (Units with the torque-control feature require dc control power at the torque-control input.)

Typical connections for phase and ground overcurrent protection are shown in Fig. 3a.

Separate time and instantaneous tripping contacts are provided to allow the use of the relay in applications such as reclosing schemes, where the instantaneous element is blocked at certain times by other relays. A trip alarm output, consisting of a parallel set of fully rated time and instantaneous contacts, is provided for signalling.

A block diagram for the relay is shown in Figure 4. Energy to power the relay's circuitry is derived from the power supply ct. The power supply section provides an unregulated 12 volts and a regulated 5 volts for the relay's circuitry. Measurement of the current is done at the secondary side of the internal signal ct. A low pass filter conditions the input signal for the gain stages. The multiplexer, sample-and-hold, and the analog to digital converter are contained within the 68HC11 8 bit micro-controller. The operating program is contained in ROM. Settings are programmed with the front panel switches. Temporary data is written to and read from the RAM. Calibration constants are held in the EEPROM. Two mechanical control relays provide the separate Time and Instantaneous tripping-output contacts, and the trip-alarm contact. The targets are set by the flow of current in the trip circuit.

Torque-Control:

"Torque-control" is available as an optional feature on models in the Circuit-Shield case. The torque-control input must be powered from the external dc control voltage supply through the controlling contact. An optocoupler is used to provide isolation. The relay functions to measure the ac current when the torque-control input is energized, and operation is defeated when the input is not energized.

Typical applications employing the torque-control feature are: Device 67, directionally-controlled-phase-overcurrent-relay using the Circuit-Shield Type 32 as the controlling unit; Device 67N, directional-ground-overcurrent-relay using the Type 32Q or 32D as the controlling unit; and Device 51V voltage-controlled-overcurrent-relay using the Circuit-Shield Type 47H as the controlling unit. In three-phase applications, the torque-control inputs of the three Micro-51 relays may be energized in parallel using one controlling contact. Typical control circuit connections for a 67/67N arrangement are shown in Figure 3b.

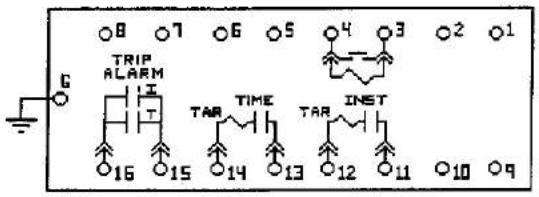
Retrofit Kits:

The Micro-51/FT design enables the relay to be retrofitted in existing CO installations. The Micro-51/FT has the same terminal connections as most CO relays with (1)NO contact arrangement; therefore, the drawout chassis can be placed into many existing CO cases without rewiring. Retrofit kits consisting of the chassis assembly and a new front cover are available: to order, add the suffix "-LC" to the catalog number.

Figure 2a: Internal Connections - Standard Units

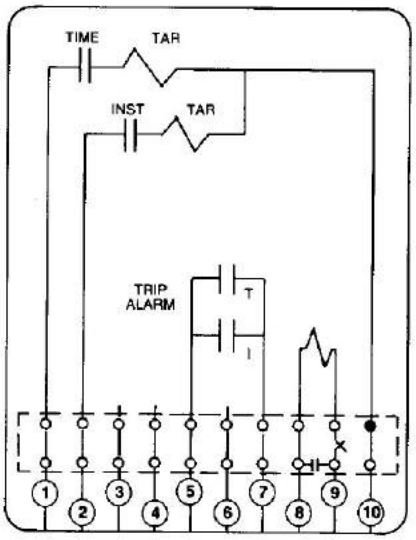
16D446A
Micro-51

Drawout
Test Case



10F446A
Micro-51/FT

FT-11
Flexitest Case



TAR = Low Impedance Series Target Coil

Contacts labelled "Trip-Alarm" have same rating as Time and Inst contacts.

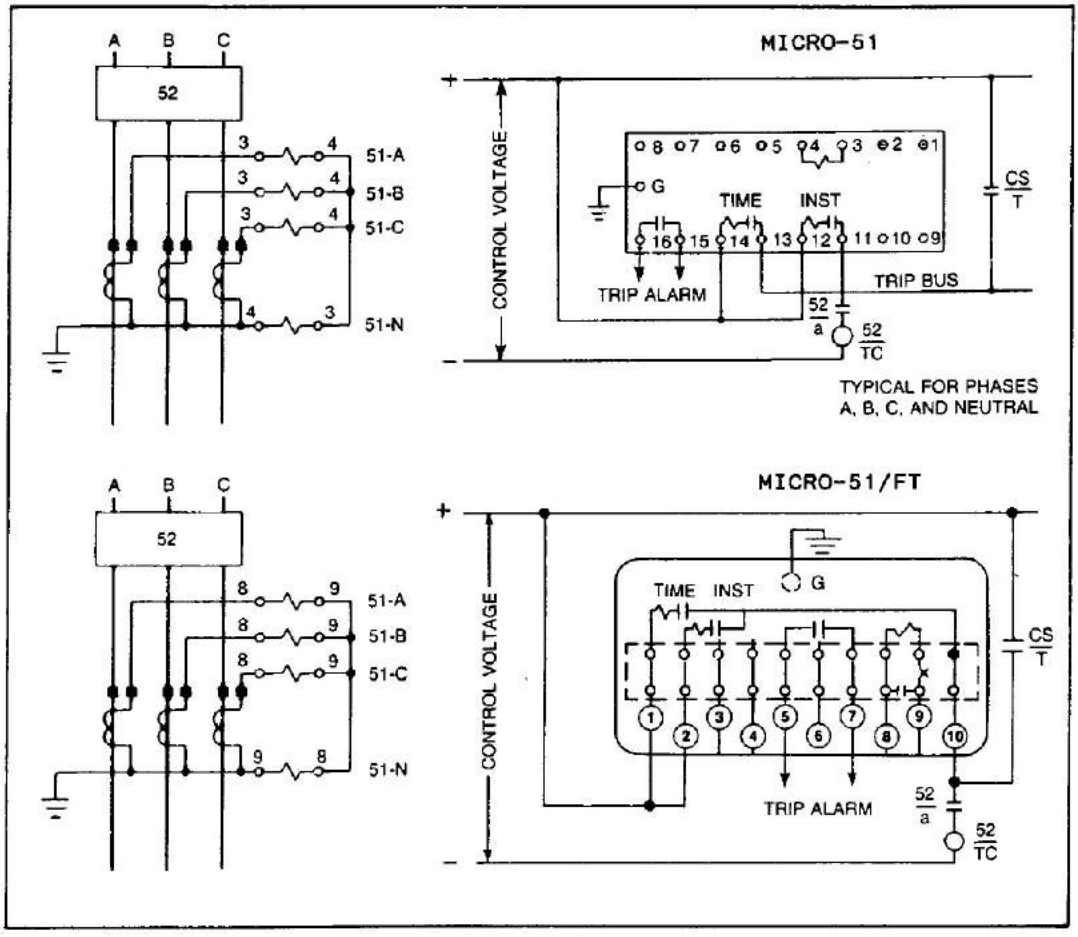
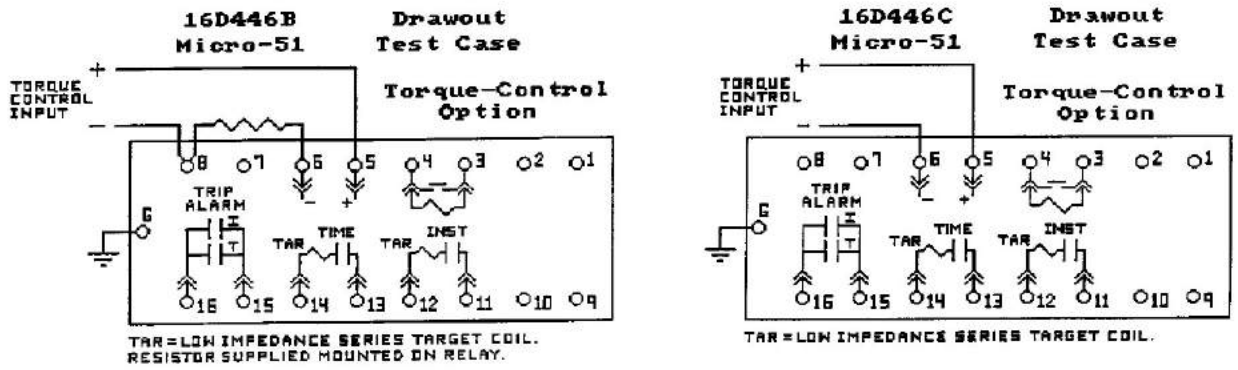


Figure 3a: Typical External Connections
Three-phase and Ground Overcurrent Protection

Figure 2b: Internal Connections - Torque-Control Models



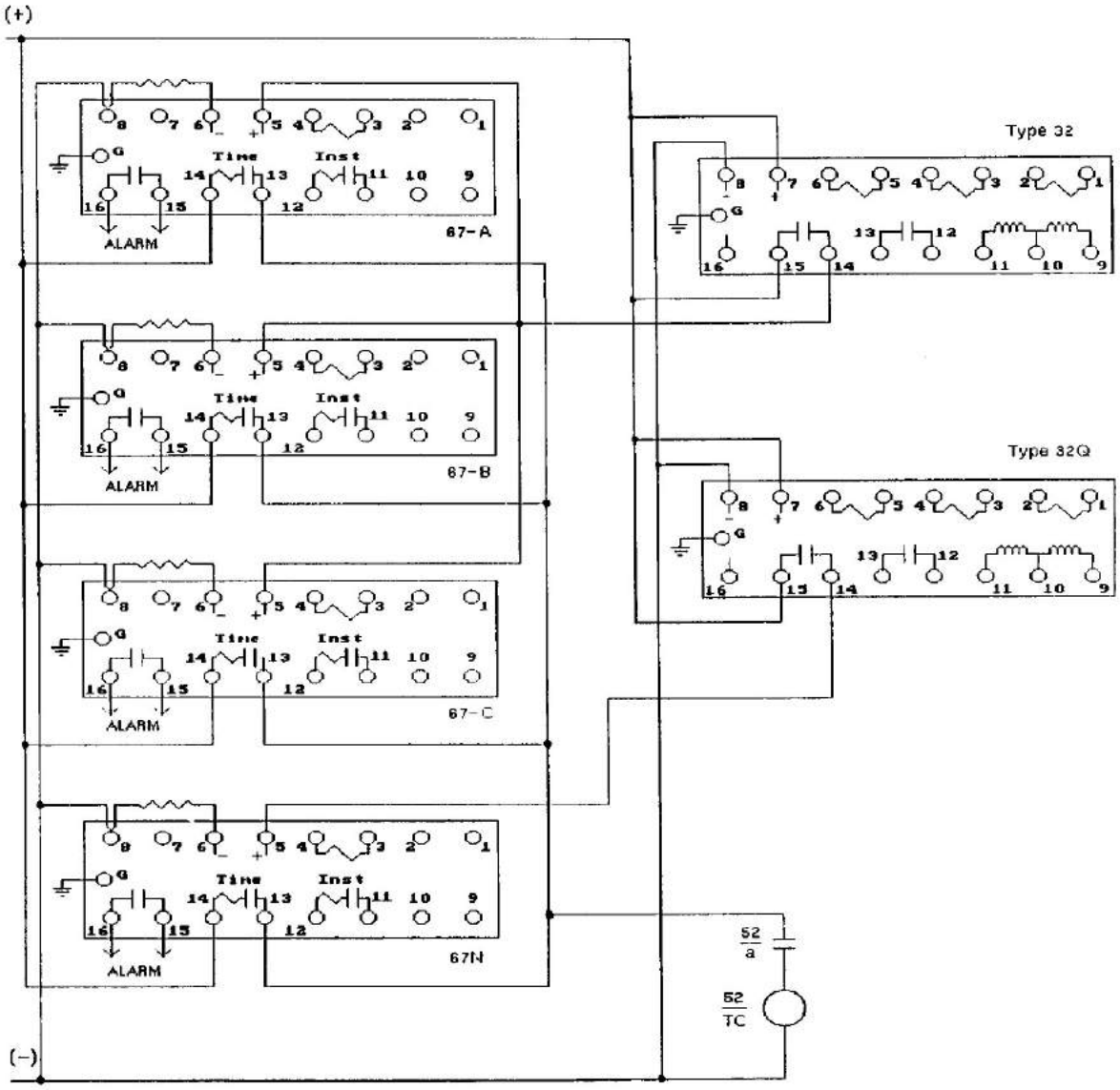


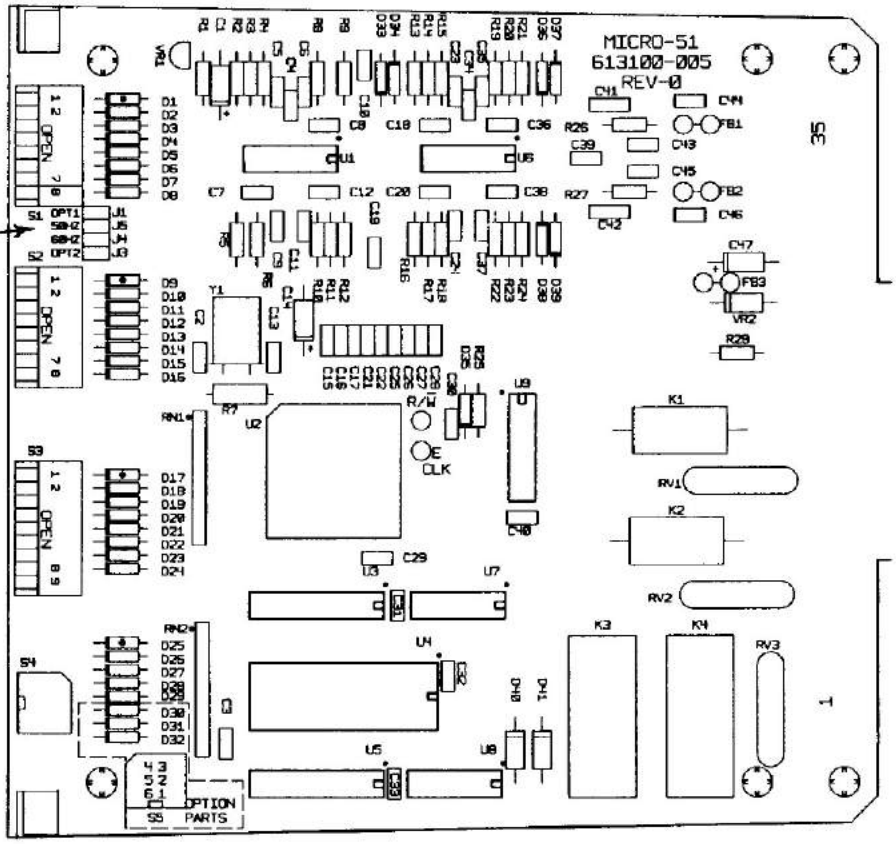
Figure 3b: Typical Control Connections - Micro-51 used with Circuit-Shield Types 32 and 32Q in a Directional Phase and Ground Overcurrent Scheme

Circuit Board Layouts - Typical

Micro-51 446S Series
Lower Circuit Board

System Frequency
Selector Link

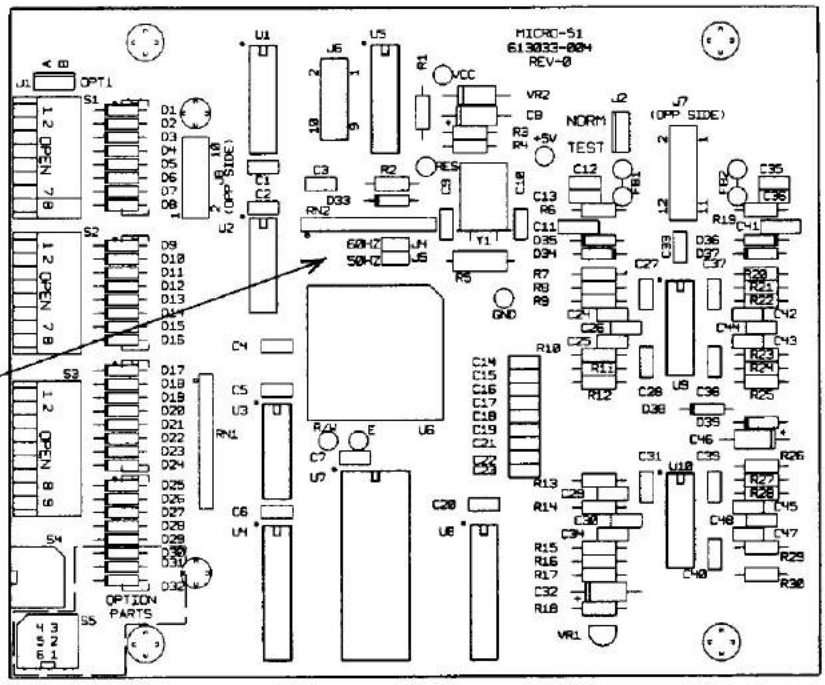
Place Plug in:
J4 for 60 Hz.
J5 for 50 Hz.



Micro-51/FT
Upper Circuit Board

System Frequency
Selector Link

Place Plug in
J4 for 60 Hz.
J5 for 50 Hz.



SPECIFICATIONS

Input Circuit:

Time Pickup: models available for:
1.5-12 amperes in 0.25 ampere increments.
0.3-2.4 amperes in 0.05 ampere increments.

Rating: 1.5-12A unit: 20 amps continuous; 400 amps, 1 sec.
0.3-2.4A unit: 4 amps continuous; 230 amps, 1 sec.

Frequency: 50 Hz. or 60 Hz., selected with internal link.

Burden: 1.5-12A unit: 2.8 VA @ 5 amperes.
0.3-2.4A unit: 2.8 VA @ 1 ampere.
(burden is non-linear, see Figure 5)

Instantaneous Pickup: settable 1-20 multiples of the time-pickup in 0.1 multiple increments.

Operating Time:

Built-in Curves: Inverse, Very Inverse, Extremely Inverse, Short-Time, Definite-Time, Long-Time Inverse, Long-Time Very Inverse, Long-Time Extremely Inverse

See Time-Current Characteristic Curves.
(Note: curves apply to both 50Hz and 60Hz operation provided the internal selector link is properly positioned to match the system frequency.)

Time-Dial: Adjustable 1-10 in increments of 0.1, except Definite Time, which is adjustable directly in seconds, 0.1-10 in 0.1 second increments.

Output Circuit:

Each Contact	@125 Vdc:	@250 Vdc:	
	30 amperes	30 amperes	tripping duty
	5 amperes	5 amperes	continuous
	0.3 ampere	0.1 amperes	break

Series Target Coil: Standard units: 1 ampere or more of trip circuit current will insure target operation. Withstand: 30 amps, 1 sec. Coil resistance: negligible.

Catalog suffix "-ST": 0.25 ampere for operation. Withstand: 10 amps, 1 sec.

Operating Temperature Range: -20 to +70 degrees C.

Control Power Drain: none; the relay is self-powered from the input current.

except: models with optional torque-control, input drain is approximately 6 milliamperes when energized.

Tolerances (over temperature range -20 to +70°C):

Time Pickup: +/-3% of tap setting.
Time Delay: +/-7% or +/-1 cycle, whichever is greater.
Instantaneous Pickup: +/- 10%.

Dielectric Strength: 2000 vac, 50/60 Hz., all circuits to ground.

Weight:

	Micro-51	Micro-51/FT
Boxed for shipment:	5.4 lbs., 2.5 kg.	9.6 lbs., 4.4 kg.
Unboxed:	4.7 lbs., 2.1 kg.	7.8 lbs., 3.5 kg.

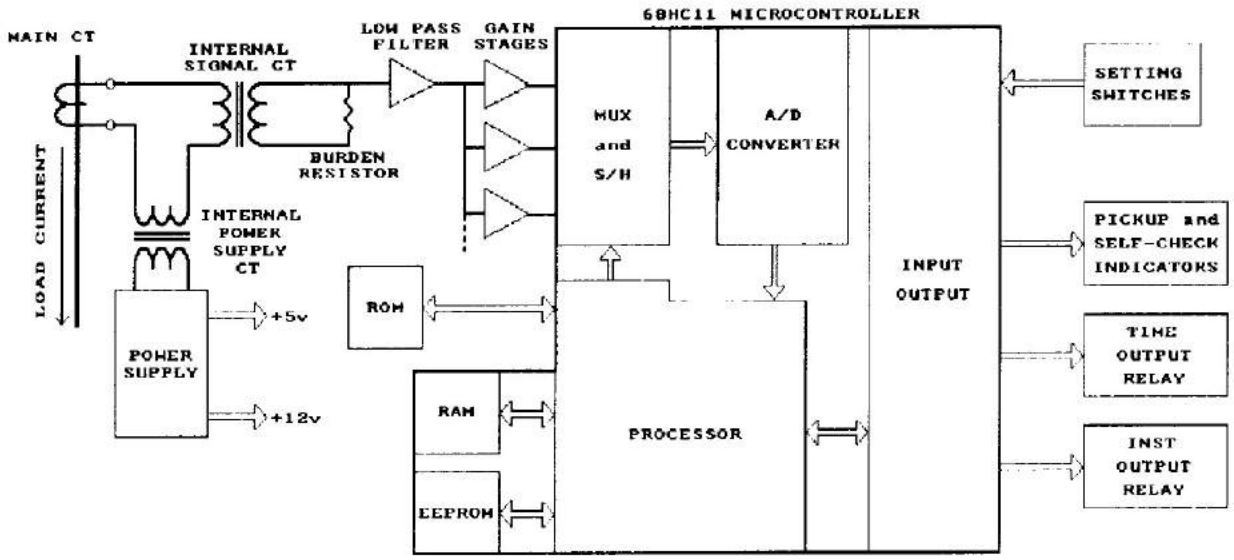


Figure 4: Block Diagram of Micro-51 Time-Overcurrent Relay

RAM = Random Access Memory MUX = Multiplexer S/H = Sample and Hold
ROM = Read Only Memory A/D = Analog to Digital
EEPROM = Electrically Eraseable Programmable Read Only Memory

The input burden of the Micro-51 relay is non-linear due to the power supply section of the relay. The power supply extracts sufficient energy from each half-cycle of the input current waveform to maintain a voltage level on certain power supply capacitors. The Volt-Ampere burden for any input current is given by the curve.

Upper Curve: 0.3-2.4 Ampere unit.

Lower Curve: 1.5-12 Ampere unit.

Note: burden is not affected by relay's settings.

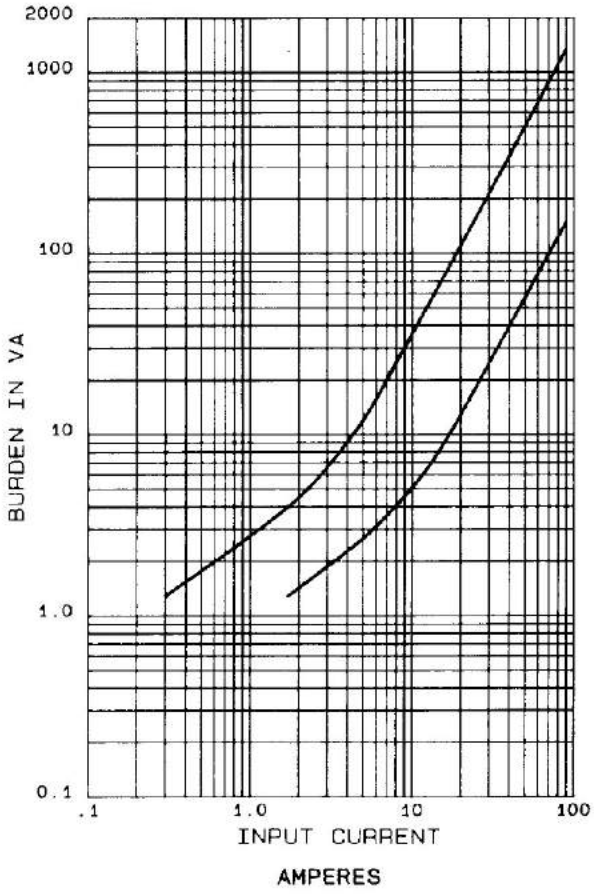
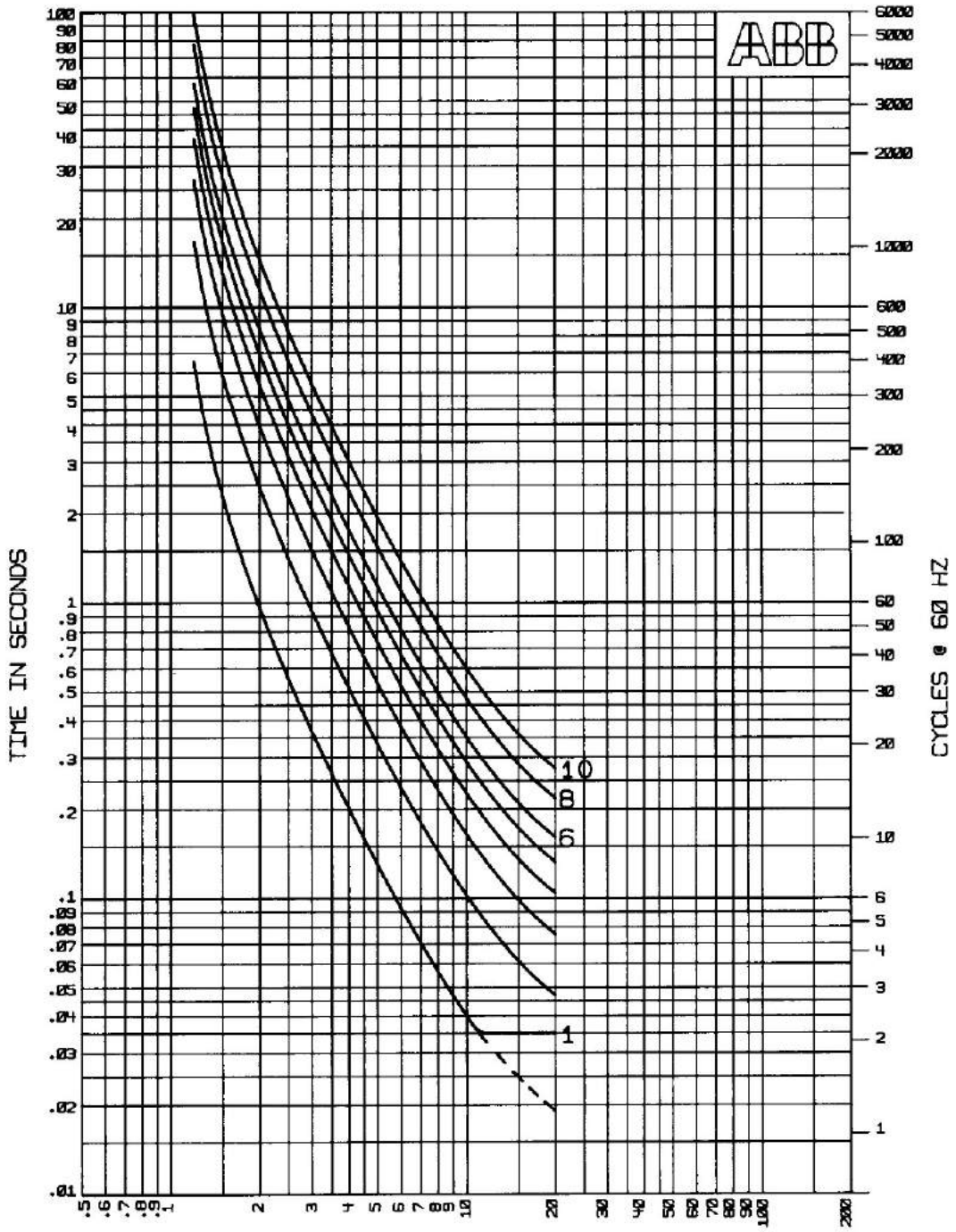


Figure 5: Relay Input Burden Data



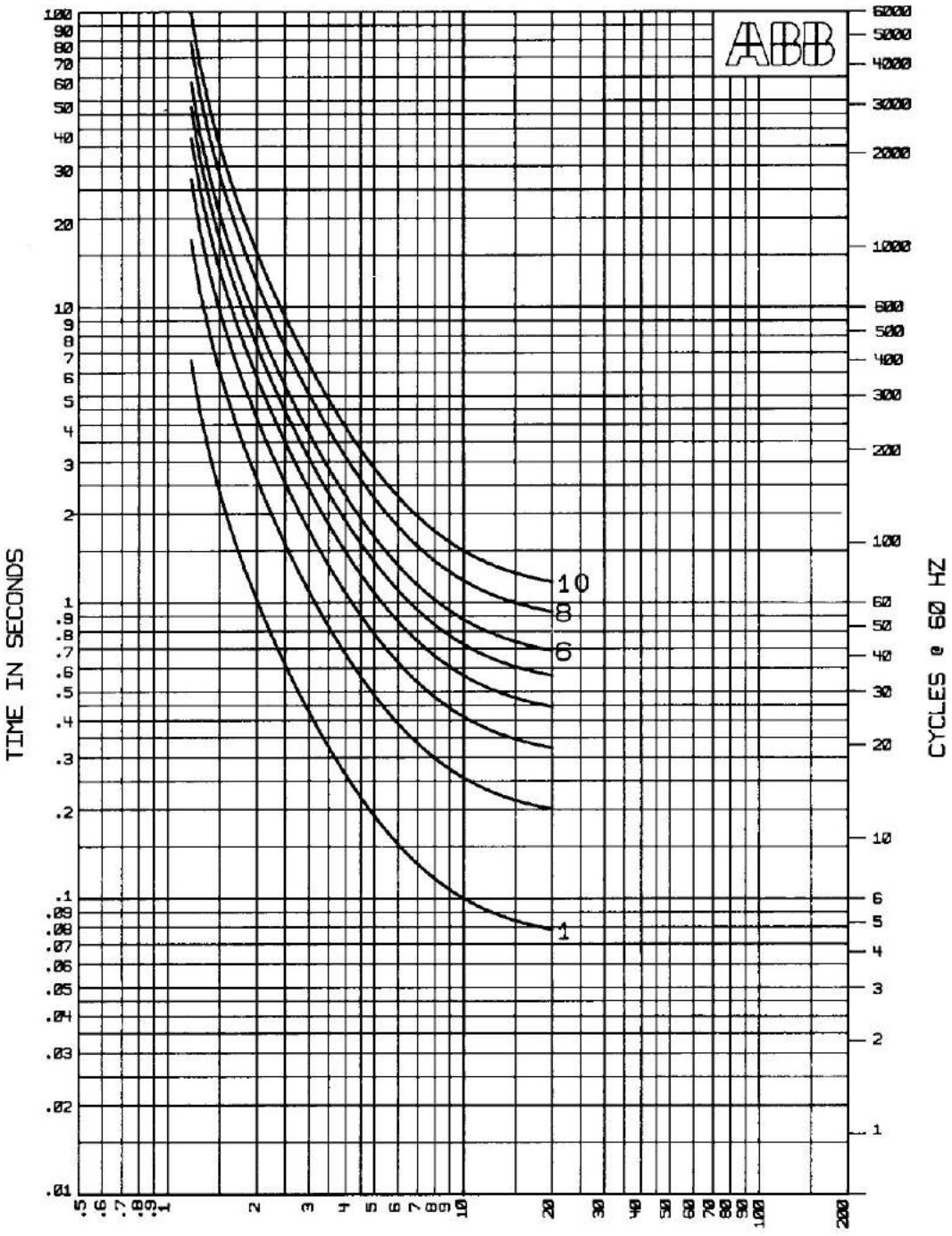
DATE		DWG NO	REV
JULY	1989	605850	2

EXTREMELY INVERSE

EXTREMELY INVERSE: TIME-CURVE SELECTOR POSITION #0 - TIME DELAY AS SHOWN

LONG TIME EXTREMELY INVERSE: TIME-CURVE SELECTOR POSITION #5 - MULTIPLY TIME DELAY SHOWN BY 10.

LONG TIME EXTREMELY INVERSE FOLLOWS DASHED CURVE ON TIME DIAL #1

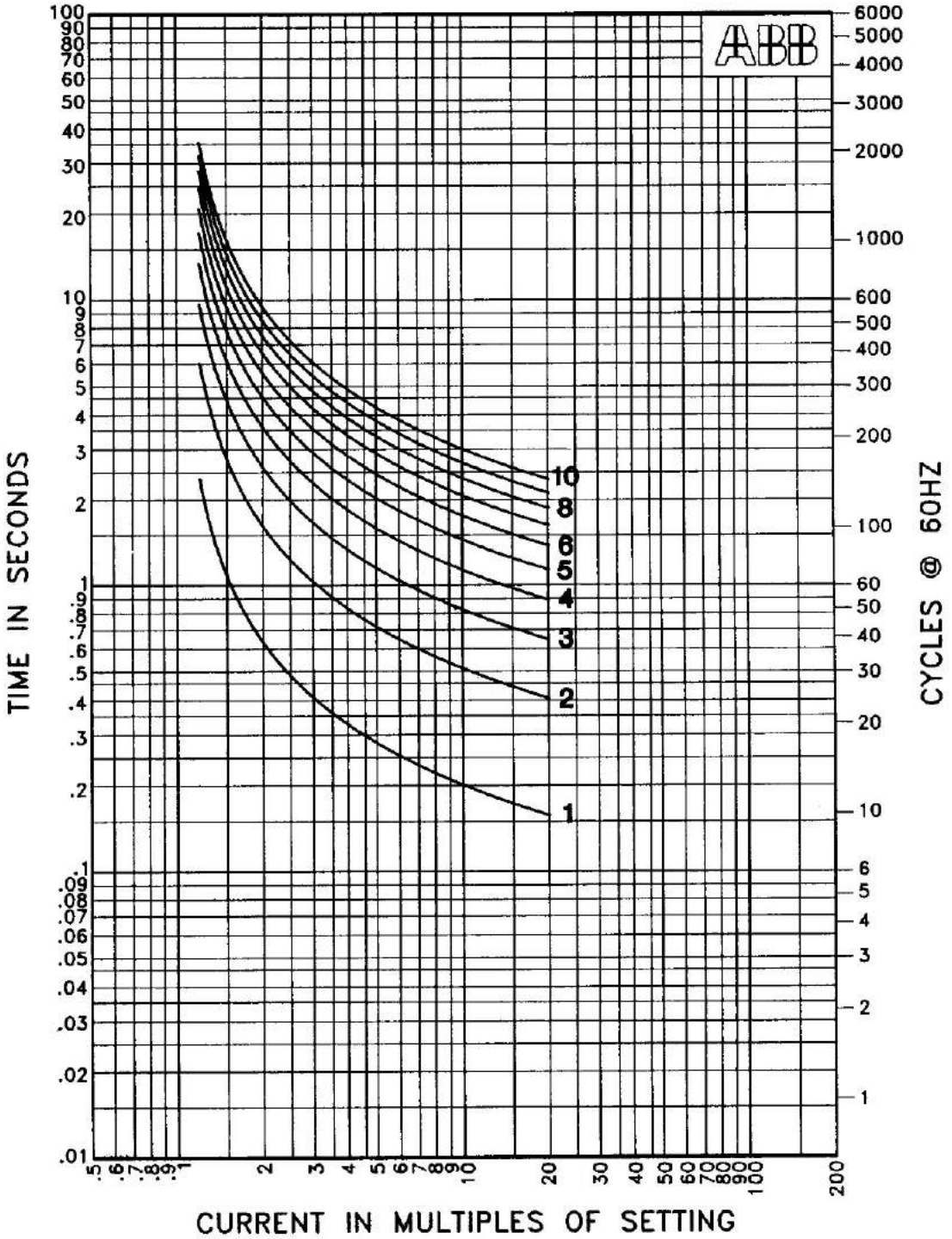


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JULY	1989	605851	2

VERY INVERSE

VERY INVERSE: TIME-CURVE SELECTOR POSITION #1 - TIME DELAY AS SHOWN

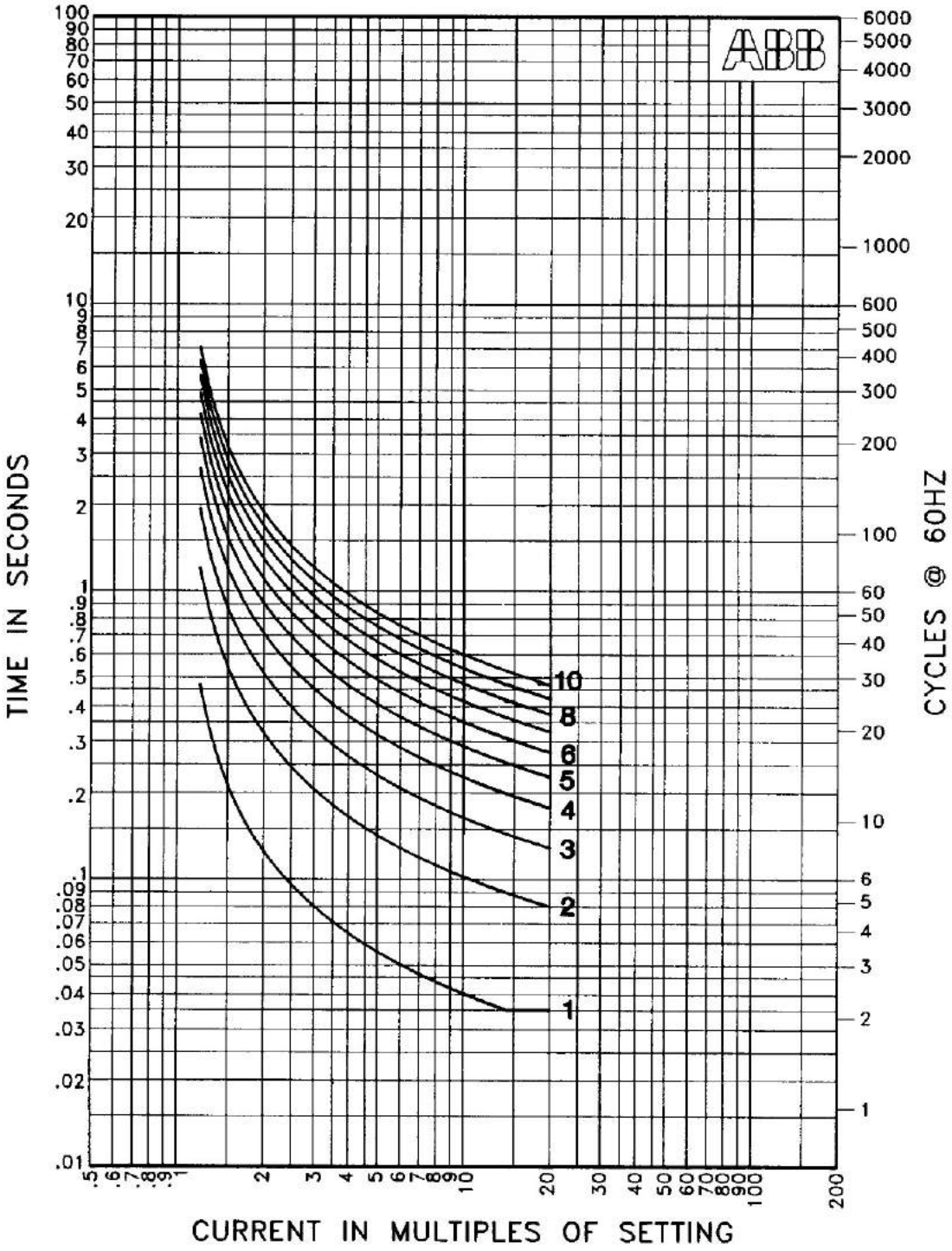
LONG TIME VERY INVERSE: TIME-CURVE SELECTOR POSITION #6 - MULTIPLY TIME DELAY SHOWN BY 10.



DATE	MICRO-51 INVERSE	DWG NO	REV
OCT 1991		605854	0

INVERSE: TIME-CURVE SELECTOR POSITION #2 - TIME DELAY AS SHOWN

LONG-TIME-INVERSE: TIME-CURVE SELECTOR POSITION #7 - MULTIPLY TIME DELAY SHOWN BY 10.



DATE		DWG NO	REV
OCT 1991	**MICRO-51 SHORT TIME INVERSE**	605855	0

SHORT TIME: TIME-CURVE SELECTOR POSITION #3 – TIME DELAY AS SHOWN

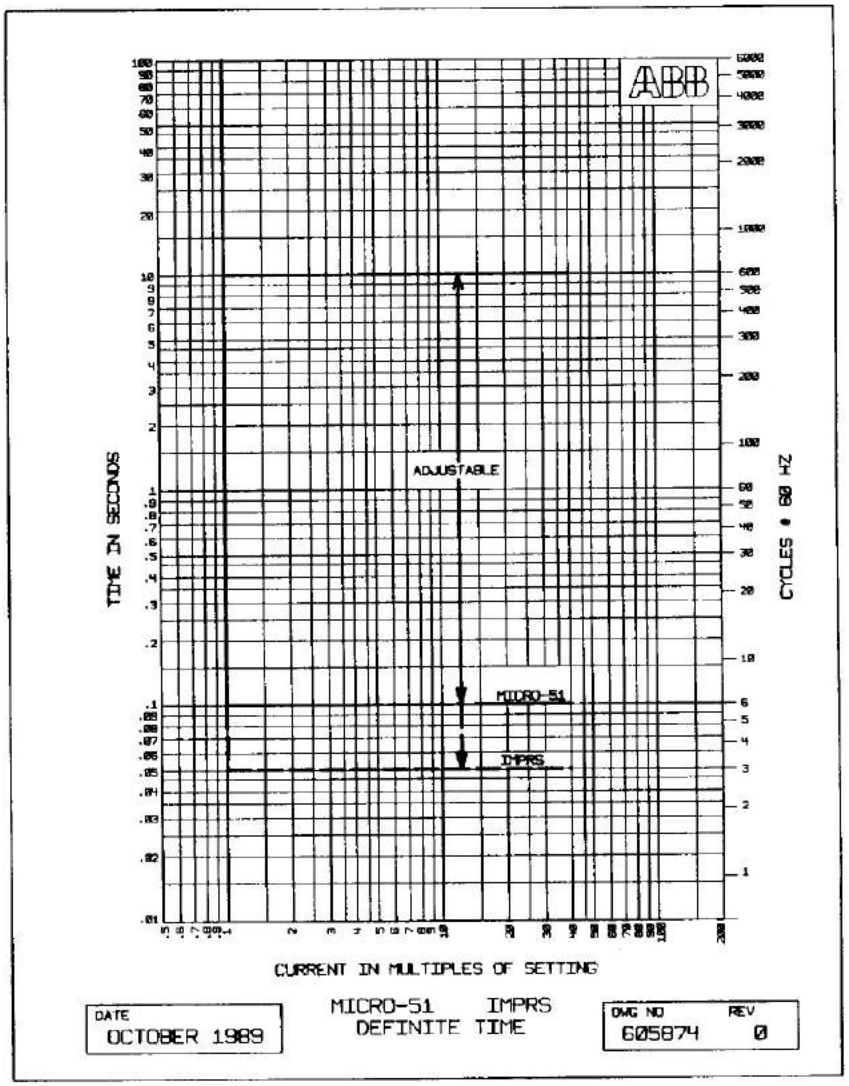
DEFINITE TIME

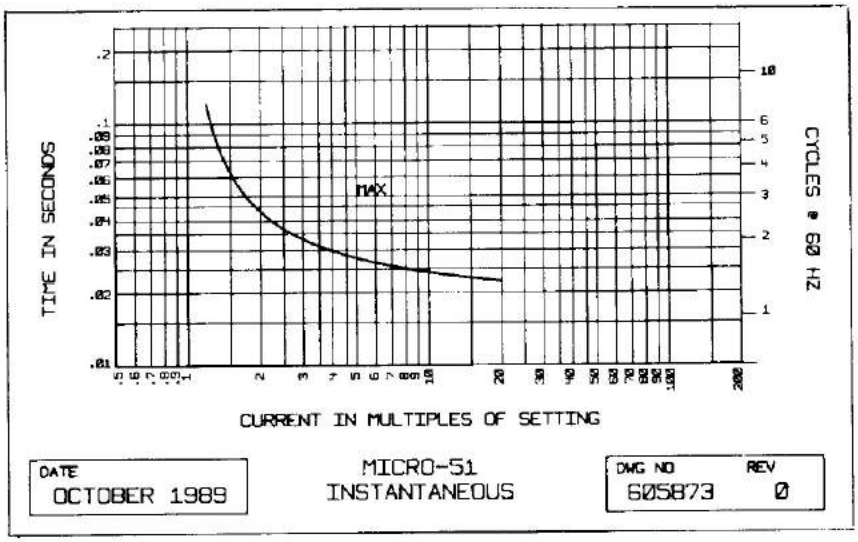
TIME-CURVE SELECTOR
POSITION #4

SET THE DELAY DIRECTLY IN SECONDS ON THE TIME-DIAL SELECTOR SWITCHES.

Range 0.1-10 seconds in 0.1 second increments.

(A setting of 0 defaults to 0.1 seconds.)





TESTING

1. MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on these relays. Follow test instructions to verify that the relay is in proper working order. We recommend that an inoperative relay be returned to the factory for repair; however, a schematic diagram will be provided on request for those who wish to troubleshoot the relay.

Caution: *since testing and troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competant technicians familiar with good safety practices should service these devices.*

Renewal parts, such as the output relays and target-head assemblies are available from the factory. Contact your nearest sales office or the factory for quotations.

MICRO-51 (CIRCUIT-SHIELD CASE)

Metal handles provide leverage to withdraw the relay assembly from the case. The assembly is identified by the catalog and serial numbers stamped on the front panel.

Test connections are readily made to the drawout relay unit by means of standard banana plugs. Current connections are made to the vertical posts at the blade assemblies. Output connections are made at the rear vertical circuit board. This rear board is marked for easy identification of the connection points.

Important: if you are testing a relay with the torque-control feature, you must energize the torque-control input with rated dc control voltage to obtain relay operation. Most units require a resistor be connected temporarily between terminals 6 and 8 on the rear vertical circuit board. (See catalog listing on page 4 and internal connection diagrams on pages 7 and 8.) The value of this resistor depends on the control voltage rating: 125vdc = 18K ohms; 48vdc = 5.6K ohms. The resistor should be rated 5 watts or higher. If no resistor is readily available, the resistor mounted on the rear of the case could be removed and used. *Be sure to remount this resistor on the case at the conclusion of testing.*

Should separation of the upper and lower circuit boards be needed, remove (2) screws that attach the left and right handle assemblies to the upper printed circuit board, and (2) screws on the underside of the unit that secure the lower board to the backplane. The lower board may then be withdrawn forward from the printed circuit connector. An 18 point extender board (cat. 200X0018) is available from the factory if access to the lower circuit board is required for troubleshooting.

Test Plug: A test plug assembly, catalog 400X0001, is available for use with the Micro-51 relay. This device plugs into the relay case on the switchboard and allows access to all external circuits wired to the case. See Instruction Book IB 7.7.1.7-8 for details on the use of this device.

MICRO-51/FT (FLEXITEST CASE)

The Flexitest case is a dust-proof enclosure combining the relay chassis unit and knife-blade test switches in the same case. Refer to publication IL 41-076 for detailed information on the use of the features of this case assembly and associated accessories.

2. HIGH POTENTIAL TESTS

High potential tests are not recommended. A hi-pot test was performed at the factory before shipping. If a control wiring insulation test is required, remove the drawout unit from the case before applying the test voltage.

3. RESPONSE OF THE RELAY TO A CHANGE IN SETTINGS

If new settings are made with the relay de-energized, the new settings will become effective immediately upon energization. If the relay is energized with an input current below its pickup setting at the time the change is made, the "new" settings become effective approximately 10 seconds after the last change is made to the front panel switches.

4. ACCEPTANCE TESTS

Operating Frequency Selector Link (Internal): An internal link is provided to set the relay for the system frequency. The relay is shipped with the link in the 60 Hz. position. To inspect or change its position, refer to the circuit board layouts on page 9.

Typical test circuit connections are shown in Figures 6 and 7.

If testing a Micro-51 with torque-control option, be sure to make proper connections to the torque-control input to obtain relay operation. Refer to page 17 and page 19 Figure 6a.

When testing, be sure to interrupt test current immediately upon relay operation. If proper relay operation is not obtained, do not let high test currents persist - shut off the test source and recheck settings and connections.

If the settings to be used in the application are known, they should be programmed on the front panel switches, see page 3. If those settings are not known at this time, set Time-Pickup at 2.0 amperes, Curve #3 (Inverse), Time-Dial #10, and Instantaneous Pickup at 6 multiples for these acceptance tests.

Time-Pickup:
The time-pickup current value can be determined by slowly raising the test current and observing the pickup led on the front panel. Pickup should be within +/-3% of the setting. (Pickup is the value at which the led is on steadily.)

Operating Time:
A timing test should be run at 2 multiples and 5 multiples of pickup to verify the curve. Connect the test set STOP input to the TIME output contact. The operating time should be within +/-7% (or +/-1 cycle if greater) of the time value shown on the appropriate time-current curve.

For the settings assumed above: a 2 ampere pickup, the Inverse curve, time dial #10, the operating time should be 9.5 seconds (+/- 0.67 sec) for the 2 multiple (4 amps test, and 4.2 seconds (+/- 0.3 sec) for the 5 multiple (10 amperes) test. (For earlier units, software version V1.0, the operating time at 2 multiples should be 9.0 seconds (+/- 0.63 sec). See notes below on software versions.)

Instantaneous Pickup:
Connect the test set STOP input to the INST output contact. Raise the test source current until relay operation is obtained. Operating current should be within +/-10% of the setting.

For the settings assumed above, a 2 ampere time-pickup setting, and instantaneous pickup at 6 multiples, operation should be obtained at 12 amperes (+/-1.2 amperes).

Self-Test Function:
The self-diagnostics program should be given time to execute during acceptance testing. With relay time-pickup set at 2.0 amperes, apply 1.5 amperes input current. Maintain this current for 60 seconds. This will allow sufficient time for the execution of the complete self-diagnostics routine. The relay's performance is proper if the Self-Test-Failure led is not illuminated at the end of the 60 second period (before the test current source is turned off).

Target Operation:
To check target operation, connect a lockout relay as a load on the output contacts as shown in figure 7. Apply test current, and verify proper target operation when the lockout relay is tripped.

Software Revisions: The software revision level of the relay is shown on the paper label on the EEPROM chip. The time-current characteristic curves shown in this issue of the instruction book apply to units with software revision V1.1 and higher. For earlier units with version V1.0, Inverse curve 605852(rev2) and Short-time curve 605853(rev2) apply. Version V1.0 units have a slightly shallower characteristic between pickup and 2 multiples. The equations for the curves are available on request.

Testing with Non-Electronic Protective Relay Test Sets:
Modern protective relay test sets which provide sine-wave test currents even when the relay burden is dynamically changing are preferred as they give excellent results and are generally easy to use. However since there are still many of the earlier vintage "voltage source" type test sets in use, the following information is given as a guide to testing with these sets:

1. Always use the highest voltage output tap possible on the test set. For example, with the MULTIAMP SR-51 or SR-76, and the EIL set, it should be possible to use the 80 volt tap for currents up to 30 amps, since the current values used over its 10 ampere rating will be on a short time basis.

2. When testing a relay with the low tap range (0.3-2.4A) at low currents, it may be necessary to add 25 ohms resistance (100 or 200 watt size) in series with one of the current leads from the test set.

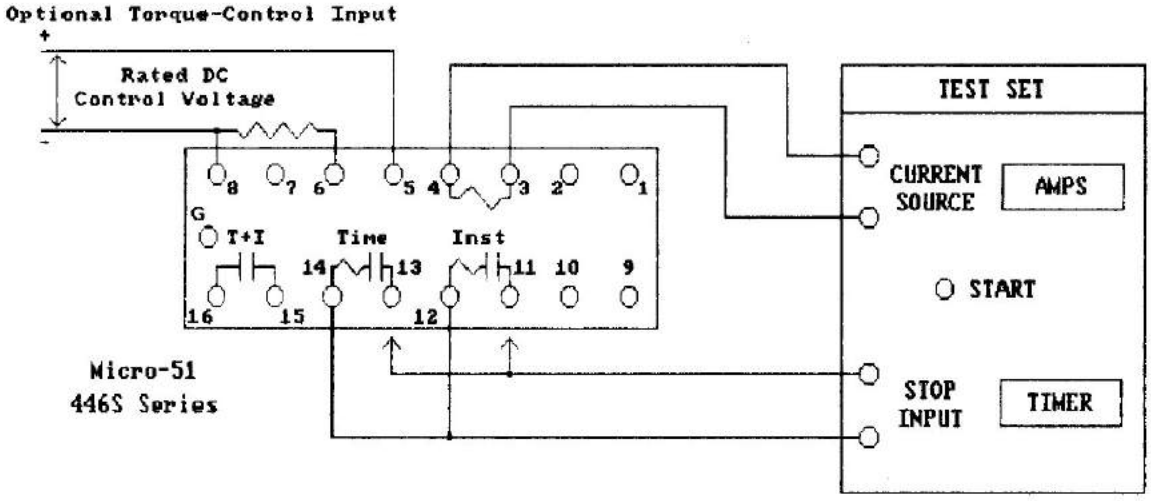


Figure 6a: Typical Test Connections - Type Micro-51

Note: connections to terminals 5, 6, 8 required only for units with the Torque-Control option. Refer to page 17.

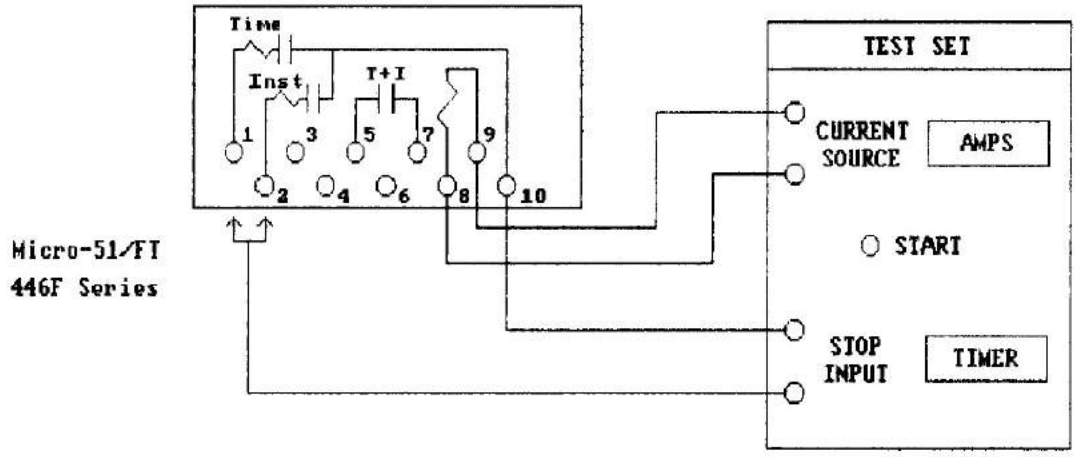


Figure 6b: Typical Test Connections - Micro-51/FT

ABB Power T&D Company Inc.
Protective Relay Division
7036 Snowdrift Rd.
Allentown, Pa. 18106
215-395-7333 Fax 215-395-1055

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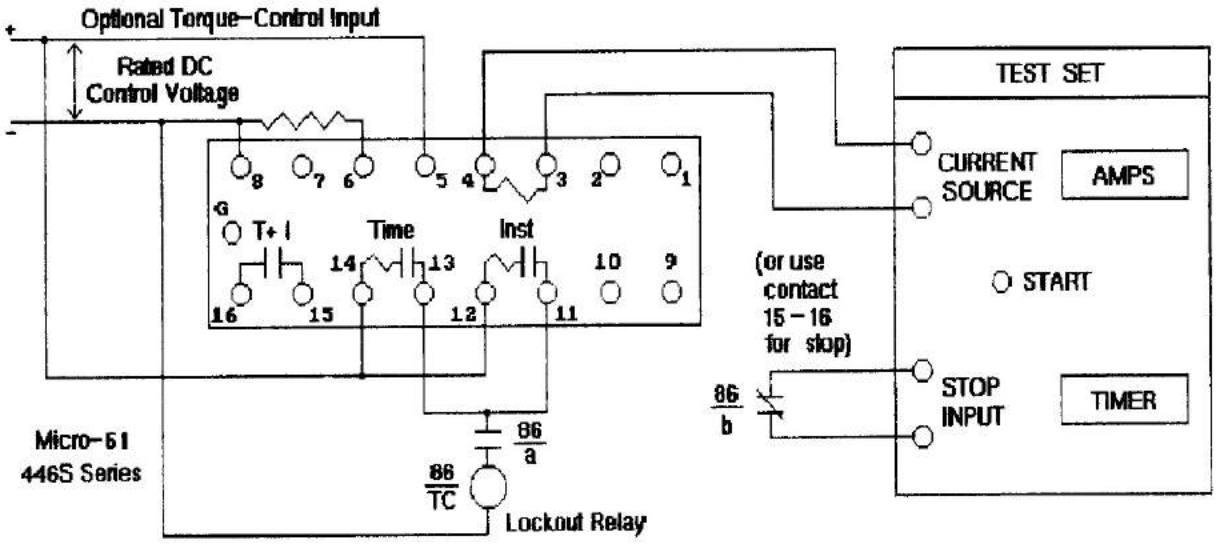


Figure 7: Typical Test Connections - Micro-51
Target Operation Functional Check

Note: Connections to terminals 5, 6, 8 required only for models with the Torque-Control option. Refer to page 17.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in conjunction with installation, operation, or maintenance. Should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Asea Brown Boveri.

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