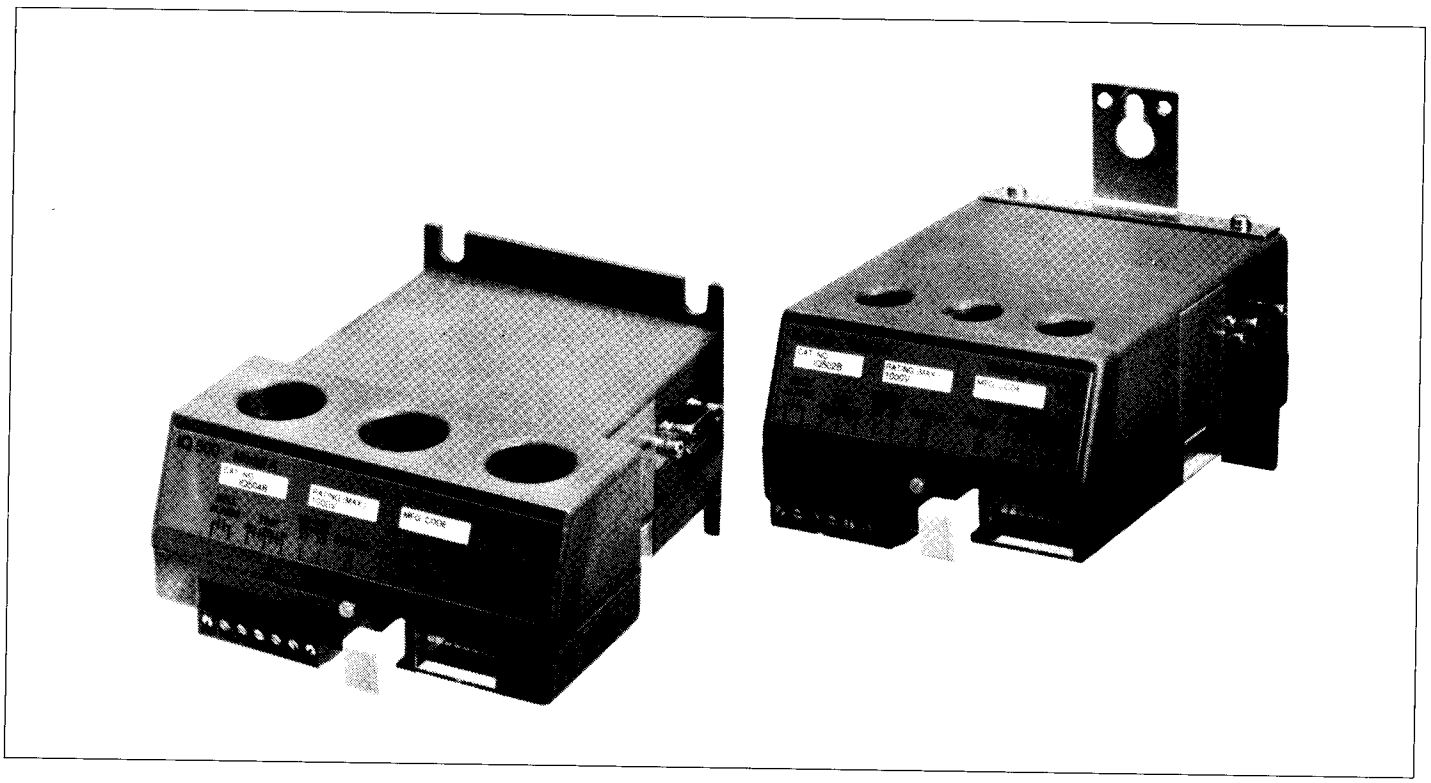
The IQ-500 Modular Overload Relay



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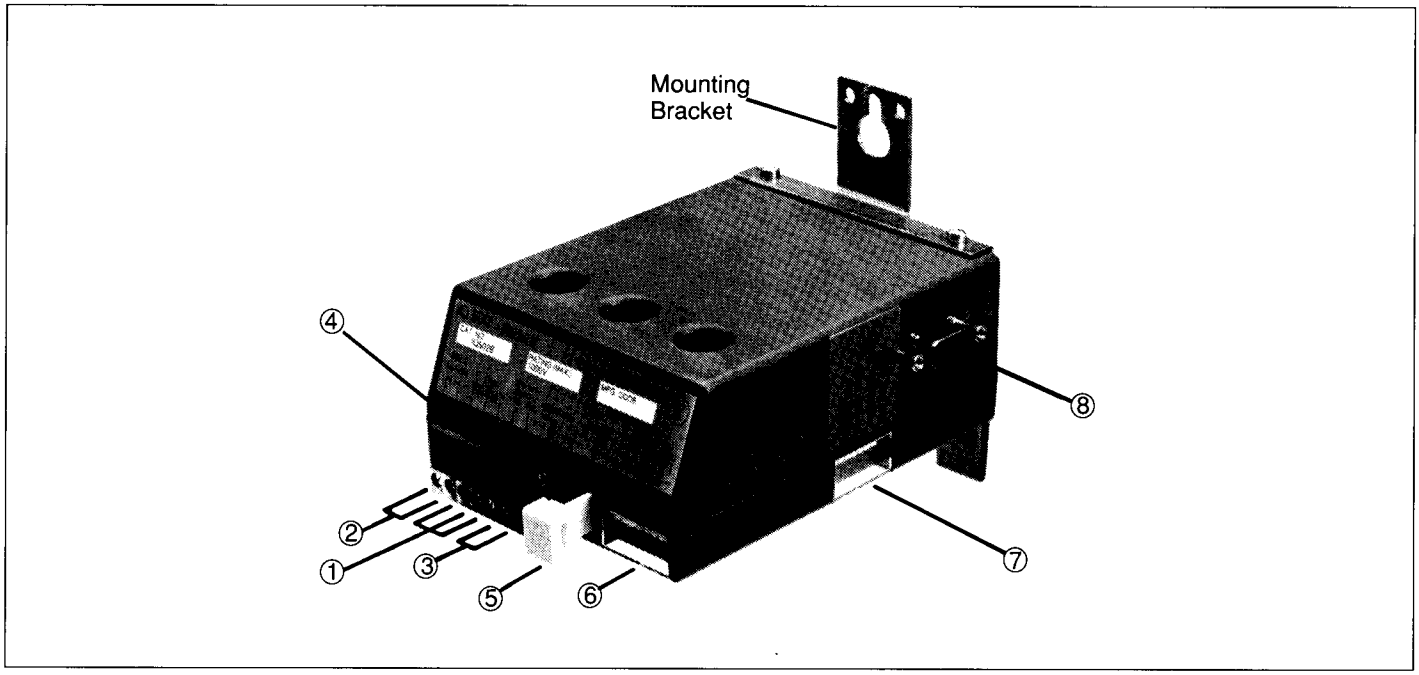

Fig. 1 IQ502 Base Relay

INTRODUCTION

1.0 General – Each IQ-500 Current-Sensing Protective Relay is an adjustable class (5,10, 20 or 30) overload relay with optional communication capabilities. Each relay is designed to provide a number of protective functions including the following:

- Overload (Overcurrent)
- Phase Unbalance
- Single Phasing
- Ground Fault

With the addition of the IQ500M Special Function Module to an IQ500L, IQ502 or IQ504, a user can obtain long acceleration time with jam and underload protection.

Settings available are:

- Underload Trip Level
- Underload Trip Delay
- Underload Start Delay
- Long Acceleration Time
- Jam Trip Level
- Jam Trip Delay
- Jam Start Delay

The IQ500M Special Function Module can also be converted to an auxiliary load control in lieu of the functions listed above.

Each IQ-500 relay should be protected against short-circuit currents by the branch circuit protection required by the National Electrical Code. All switches should be set to the desired positions before power is applied to the relay.

Each IQ-500 relay is a three-pole, block type device (See Figure 1) with a Form C trip relay①, and an isolated annunciator (alarm) relay②. Located at the front of the relay are the control power terminals③, a status LED④, a reset button⑤, and an eight-position DIP switch marked DIP 1⑥ used to set the overload relay class, reset method, and the current (trip) rating of the relay. On the side of the relay there is a second eight-position DIP switch⑦. This latter DIP switch (marked DIP 2) selects the power circuit frequency to be monitored (50 or 60 hertz), auxiliary-trip reset time, phase-unbalance level, ground-fault trip level and ground-fault trip delay. A receptacle⑧ for connection to a communications module is adjacent to this DIP switch (DIP 2).

1.1 Theory of Operation – Each IQ-500 relay is controlled by a microprocessor that takes data from line currents. Logic decisions are made based on this data and the settings selected. Values are based on a sinusoidal wave form at either 50 or 60 hertz. The microprocessor also controls the relay outputs and the light emitting diode (LED).

1.2 Options – There are two options available for use with each IQ500 Modular Overload Relay:

- Special Functions Module IQ500M as described above
- Communications

Each Relay is capable of exchanging data with a computer by means of a Communication Module, called PONI (Product Operated Network Interface). With the PONI module installed, electrical operating data will be supplied over a two-wire communication link. This module mounts on the bottom of the IQ500 device. It can be added at any time. It will provide information about the IQ500L; IQ502, or IQ504 to a IMPACC or RS232 network.

1.3 Features – All current settings on any one relay are based on one reference current selected by the user. This reference current is the overload trip current selected on the basis of motor service factor and full load current. Each relay can be programmed for motor full-load currents up to 5.75 Amperes for the IQ500L, up to 71 Amperes for the IQ502 and up to 226 Amperes for the IQ504 with no external current transformers. The "pass through" design does not require either line or load terminals. A DIP switch setting is used in place of "heater modules" for overcurrent protection. Each relay has a selectable automatic, manual, or electrical reset capability. Each relay must be set for either 50 or 60 Hz application. Units are available for either 110-120 VAC or 220-240 VAC control power. Cables connected through the pass through current sensors must be insulated and suitably rated for the system voltage. Each unit has two isolated relay outputs, one for an alarm and one for trip. There is a bell alarm contact for remote annunciation, ideal if the LED on the relay is out of view or cannot be accessed. The cause of trip is held in memory through any power loss.

1.4 Specifications – Device Power requirement:
5VA control Power:

Control Power:
110-120VAC- Model IQ500LA, IQ502A, IQ504A
220-240VAC- Model IQ500LB, IQ502B,IQ504B

Supply Characteristics:
Nominal Control Voltage +/-20% at 50 or 60 hertz

Operating Ambient Temperature:
-20° to 65° C

Storage Ambient Temperature:
-20° to 85° C, 0-95%
relative humidity noncondensing

Base Relay Trip/Alarm and Auxiliary Module JAMM/ULM contact ratings:
C300
220-240VAC, 60Hz
220VAC, 50Hz

INSTALLATION AND SETTINGS

2.0 Installation – This industrial type control is designed to be installed, operated, and maintained by adequately trained individuals. These instructions do not cover all details, variations, or combinations, of the equipment, its storage, delivery, installation, operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

2.1 IQ-500 Line DIP Switches – The DIP switches located on the front and right side of each relay unit must be set to application requirements. Each DIP switch contains eight single-throw switches. DIP switches are shipped with all eight switches in the OFF condition, which is with the lever away from the position numbers. To turn a switch to the ON condition slide the lever toward the position number. To program a DIP switch, first remove the screw that holds the plastic cover.

NOTE: In the tables that follow, ON is shown as "1" and OFF is shown as "0".

DIP switch 1 located at the front of the relay will program the following:

Overload Settings – The motor full-load current is the basis for using Positions 5 through 1. The settings are obtained using Table A for the IQ500L, Table B for the IQ502, and Table C for the IQ504. Settings shown are those which comply with Article 430 of the National Electrical Code in relating motor full-load current (F.L.A.) and service factor to relay trip current rating. The overload trip current rating selected becomes the reference current and the basis for the special function settings of the

IQ500M. Where the motor service factor is not known, assume S.F. to be 1.00

The cold start overcurrent trip curves are shown in Figure 2 for all four classes of overload protection. Hot starting will result in faster trip times.

Overload Class – The overload trip class is set using Positions 7 and 6 of the same DIP switch (DIP 1). Class should be selected based on the desired protection.

Overload Class	Setting for Position 7	Setting for Position 6	Maximum Tripping Time When Carrying 600% of Rated Trip Current
5	0	0	5 seconds
10	0	1	10 seconds
20	1	0	20 seconds
30	1	1	30 seconds

If the proper overload setting for the motor full-load current has been made and the IQ-500 trips before the motor accelerates to full speed (and the motor is free to rotate), select the next higher overload class. Do not select a class higher than that recommended by the motor manufacture. If an IQ500M is attached, use the long acceleration provision (3.2.2) before changing overload class.

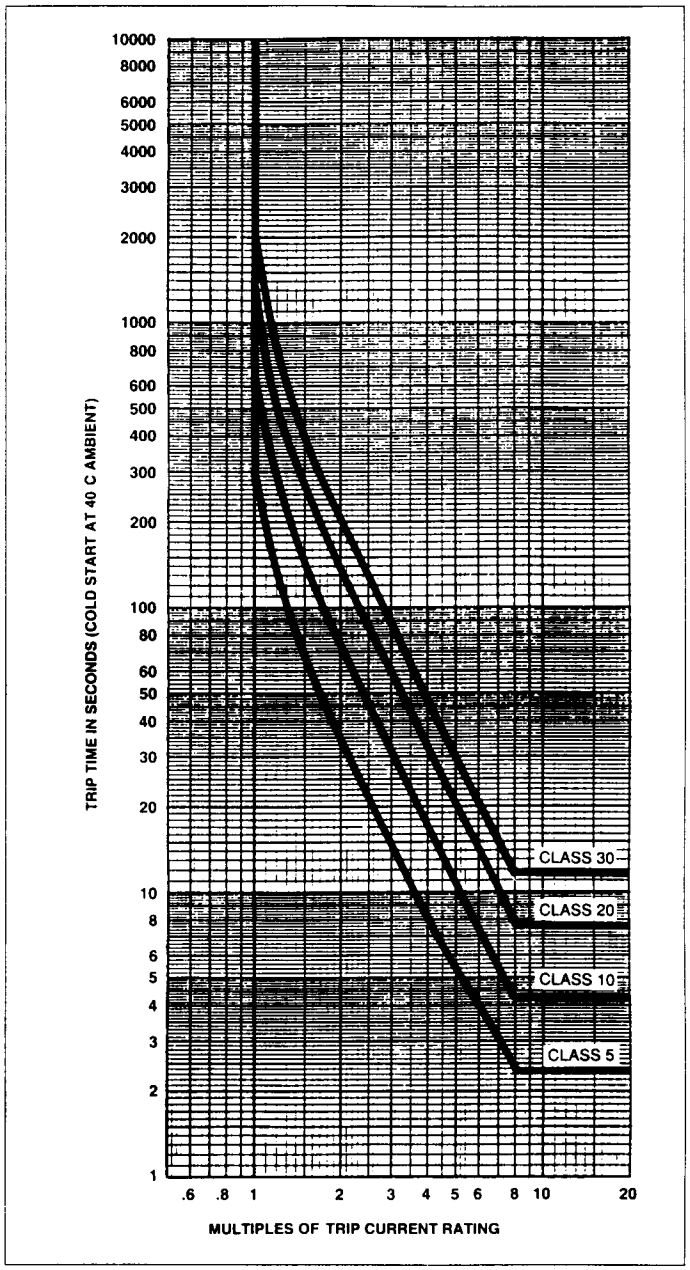

Fig. 2 Time-Current Characteristic (cold start)

TABLE A: OVERCURRENT PROTECTION FOR IQ500L DIP SWITCH POSITIONS 5 THROUGH 1 FROM LEFT TO RIGHT 1 = ON & 0 = OFF

	Service Factor 1.0	Service Factor 1.15 - 1.25	Setting for Position
Trip Rating * (Amperes)	F.L.A. Range	F.L.A. Range	(54321)
.36	.32 - .33	.29 - .31	00000
.39	.34 - .37	.32 - .34	00001
.43	.38 - .40	.35 - .37	00010
.47	.41 - .44	.38 - .40	00011
.51	.45 - .48	.41 - .44	00100
.56	.49 - .53	.45 - .48	00101
.61	.54 - .58	.49 - .53	00110
.67	.59 - .63	.54 - .58	00111
.73	.64 - .69	.59 - .63	01000
.80	.70 - .76	.64 - .70	01001
.88	.77 - .83	.71 - .76	01010
.96	.84 - .91	.77 - .83	01011
1.05	.92 - .99	.84 - .91	01100
1.15	1.00 - 1.09	.92 - 1.00	01101
1.26	1.10 - 1.19	1.01 - 1.10	01110
1.38	1.20 - 1.31	1.11 - 1.20	01111
1.51	1.32 - 1.44	1.21 - 1.32	10000
1.66	1.45 - 1.58	1.33 - 1.45	10001
1.82	1.59 - 1.73	1.46 - 1.59	10010
2.00	1.74 - 1.91	1.60 - 1.75	10011
2.20	1.92 - 2.10	1.76 - 1.93	10100
2.42	2.11 - 2.31	1.94 - 2.12	10101
2.66	2.32 - 2.53	2.13 - 2.33	10110
2.92	2.54 - 2.78	2.34 - 2.56	10111
3.21	2.79 - 3.06	2.57 - 2.82	11000
3.53	3.07 - 3.37	2.83 - 3.10	11001
3.88	3.38 - 3.70	3.11 - 3.41	11010
4.27	3.71 - 4.08	3.42 - 3.75	11011
4.70	4.09 - 4.49	3.76 - 4.13	11100
5.17	4.50 - 4.93	4.14 - 4.54	11101
5.68	4.94 - 5.42	4.55 - 4.99	11110
6.25	5.43 - 5.75	5.00 - 5.50	11111

* FUSE OR CIRCUIT BREAKER PROTECTION MUST BE PER THE NATIONAL ELECTRIC CODE.

TABLE B: OVERCURRENT PROTECTION FOR IQ502 DIP SWITCH 1, POSITIONS 5 THROUGH 1 FROM LEFT TO RIGHT 1 = ON & 0 = OFF

	Service Factor 1.0	Service Factor 1.15 - 1.25	Setting for Position
Trip Rating * (Amperes)	F.L.A. Range	F.L.A. Range	(54321)
3.93	3.43 - 3.75	3.15 - 3.46	00000
4.33	3.76 - 4.13	3.47 - 3.81	00001
4.77	4.14 - 4.55	3.82 - 4.19	00010
5.25	4.56 - 4.99	4.20 - 4.61	00011
5.77	5.0 - 5.4	4.62 - 5.0	00100
6.35	5.5 - 6.0	5.1 - 5.5	00101
6.9	6.1 - 6.5	5.6 - 6.0	00110
7.7	6.6 - 7.2	6.1 - 6.6	00111
8.5	7.3 - 8.0	6.7 - 7.3	01000
9.3	8.1 - 8.8	7.4 - 8.1	01001
10.2	8.9 - 9.6	8.2 - 8.9	01010
11.2	9.7 - 10.6	9.0 - 9.8	01011
12.4	10.7 - 11.7	9.9 - 10.8	01100
13.6	11.8 - 12.9	10.9 - 11.9	01101
15.0	13.0 - 14.2	12.0 - 13.1	01110
16.5	14.3 - 15.7	13.2 - 14.4	01111
18.1	15.8 - 17.2	14.5 - 15.8	10000
19.9	17.3 - 18.9	15.9 - 17.4	10001
21.9	19.0 - 20.9	17.5 - 19.2	10010
24.1	21.0 - 22.9	19.3 - 21.1	10011
26.5	23.0 - 25.2	21.2 - 23.2	10100
29.1	25.3 - 27.8	23.3 - 25.6	10101
32.1	27.9 - 30.5	25.7 - 28.1	10110
35.3	30.6 - 33.7	28.2 - 31.0	10111
38.9	33.8 - 37.0	31.1 - 34.1	11000
42.8	37.1 - 40.7	34.2 - 37.5	11001
47.0	40.8 - 44.8	37.6 - 41.2	11010
51.6	44.9 - 49.3	41.3 - 45.4	11011
56.9	49.4 - 53	45.5 - 49.9	11100
62.5	54 - 59	50 - 54	11101
68.7	60 - 65	55 - 60	11110
76.2	66 - 71	61 - 66	11111

TABLE C: OVERCURRENT PROTECTION FOR IQ504 DIP SWITCH 1, POSITIONS 5 THROUGH 1 FROM LEFT TO RIGHT 1 = ON & 0 = OFF

	Service Factor 1.0	Service Factor 1.15 - 1.25	Setting for Position
Trip Rating * (Amperes)	F.L.A. Range	F.L.A. Range	(54321)
12.4	10.8 - 11.7	9.9 - 10.8	00000
13.6	11.8 - 12.9	10.9 - 11.9	00001
15.0	13.0 - 14.2	12.0 - 13.1	00010
16.5	14.3 - 15.7	13.2 - 14.4	00011
18.1	15.8 - 17.2	14.5 - 15.8	00100
19.9	17.3 - 18.9	15.9 - 17.4	00101
21.9	19.0 - 20.9	17.5 - 19.2	00110
24.1	21.0 - 22.9	19.3 - 21.1	00111
26.5	23.0 - 25.2	21.2 - 23.2	01000
29.1	25.3 - 27.8	23.3 - 25.6	01001
32.1	27.9 - 30.6	25.7 - 28.1	01010
35.3	30.7 - 33.7	28.2 - 31.0	01011
38.9	33.8 - 37.1	31.1 - 34.1	01100
42.8	37.2 - 40.8	34.2 - 37.5	01101
47.0	40.9 - 44.8	37.6 - 41.2	01110
52	44.9 - 49.4	41.3 - 45.4	01111
57	49.5 - 53	45.5 - 49.9	10000
63	54 - 59	50 - 54	10001
69	60 - 65	55 - 60	10010
76	66 - 72	61 - 66	10011
84	73 - 78	67 - 72	10100
91	79 - 87	73 - 80	10101
101	88 - 96	81 - 88	10110
111	97 - 104	89 - 96	10111
121	105 - 115	97 - 106	11000
134	116 - 127	107 - 117	11001
148	128 - 140	118 - 129	11010
163	141 - 154	130 - 142	11011
179	155 - 170	143 - 156	11100
196	171 - 187	157 - 172	11101
216	188 - 206	173 - 189	11110
238	207 - 226	190 - 208	11111

* FUSE OR CIRCUIT BREAKER PROTECTION MUST BE PER THE NATIONAL ELECTRIC CODE.

Reset Action – The reset mode is determined by Position 8 of DIP switch 1. If the position 8 switch is OFF, the relay will require manual resetting. This can be either an electrical or true manual reset. Electrical reset is desirable when the relay is not accessible, as with explosion proof enclosures. A true manual reset requires the reset button be depressed locally. If the switch is ON, the relay will automatically reset after the reset times shown below. If manual reset is chosen, the unit will not allow a reset until the reset times have elapsed.

Class 5 reset = approximately 50 seconds

Class 10 reset = approximately 100 seconds

Class 20 reset = approximately 200 seconds

Class 30 reset = approximately 300 seconds

NOTE: If long acceleration is selected on the IQ500M these reset times will be changed. See 3.2.2.

DIP switch 2 located on the right hand side of the unit will program the following:

Ground-Fault Trip Level – Use Positions 2 and 1 to select the current level at which the relay will trip on a ground-fault condition.

Ground Fault Current		Setting for Position 2	Setting for Position 1
IQ500L	IQ502 and IQ504		
Inhibited (no ground-fault sensing)	Inhibited (no ground-fault sensing)	0	0
3 amperes	5 amperes	0	1
5 amperes	7 amperes	1	0
7 amperes	12 amperes	1	1

NOTES: **(A) Ground-fault should be inhibited when the relay is used with external CT's.**

(B) The ground-fault trip can only be reset manually.

Ground-Fault Trip Delay – Use Positions 4 and 3 to select the time delay appropriate for the ground-fault trip current selected. Tolerance on trip time is -.5 secs. to +1.3 secs.

Ground-Fault Delay Time	Setting for Position 4	Setting for Position 3
2 seconds	0	0
3 seconds	0	1
4 seconds	1	0
5 seconds	1	1

The ground-fault protection system is not sufficiently sensitive to protect personnel. It is not a Ground-Fault Circuit-Interrupter as defined by the National Electrical Code. It provides Class II ground-fault protection similar to that as defined in Underwriters Laboratories, Inc., Standard for Safety, UL 1053, Ground -Fault Sensing and Relaying equipment. As such it inhibits the opening of the contactor to which it is connected if the fault current exceeds the interrupting capability of the contactor. The inhibit current values are as follows:

For IQ500L units, the device might not trip on ground fault for phase currents in the range of 690 percent to 880 percent of the device current rating and will not trip above 880 percent of the rating. The device might not trip on ground fault for fault currents 45 amps to 55 amps and will not trip above 55 amps.

For IQ502 units, the device might not trip on ground fault for phase currents in the range of 690 percent to 880 percent of the device current rating and will not trip above 880 percent of the rating. The device might not trip on ground fault for fault currents 430 amps to 495 amps and will not trip above 495 amps.

For IQ504 units, the device might not trip on ground fault for phase currents in the range of 690 percent to 880 percent of the device current rating and will not trip above 880 percent of the rating. The device might not trip on ground fault for fault currents 1350 amps to 1737 amps and will not trip above 1737 amps.

The relay is designed so that its output relates to ground-fault current only. It is not responsive to phase-to-phase or phase-to-neutral fault current.

Phase Unbalance – Positions 6 and 5 of DIP switch 2 are used to program the conditions required to cause a phase-unbalance or phase-loss trip. Phase unbalance is defined by the formula shown below. Phase-loss is an extreme case of phase unbalance, i.e., greater than any phase unbalance value selected. Trip time is shown in Fig. 3. Minimum FLA for Phase Unbalance trip is 45%.

Percent Unbalance $= \frac{I_{max} - I_{min}}{I_{max}} \times 100$, where I_{max} and I_{min} are maximum and minimum line currents respectively.

Phase Unbalance	Start-up Delay	Setting for position 6	Setting for Position 5
Inhibited		0	0
10%	15 seconds	0	1
20%	none	1	0
50%	none	1	1

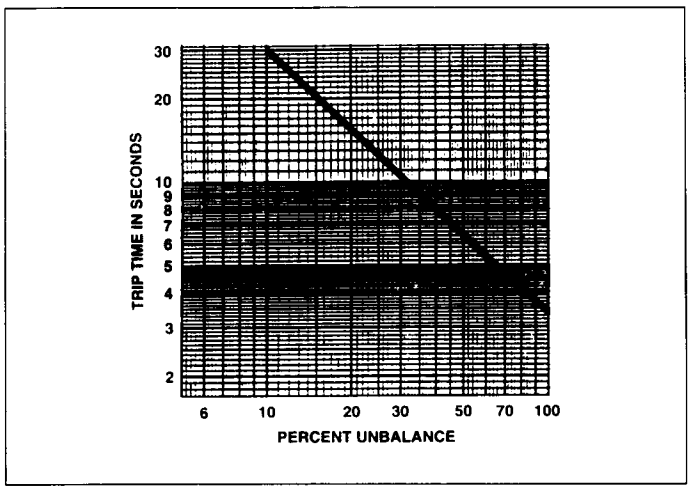

Fig. 3 Phase Unbalance Trip

Auxiliary trip reset Time – Position 7 of DIP switch 2 is used to set the reset time associated with any automatic reset. This reset time-delay will be active only if the reset selection (Position 8) of DIP switch 1 is in the ON position. Position 7 sets the time for resetting all auxiliary functions (except for overload protection).

Automatic Reset Time	Setting for Position 7
10 seconds	0
90 seconds	1

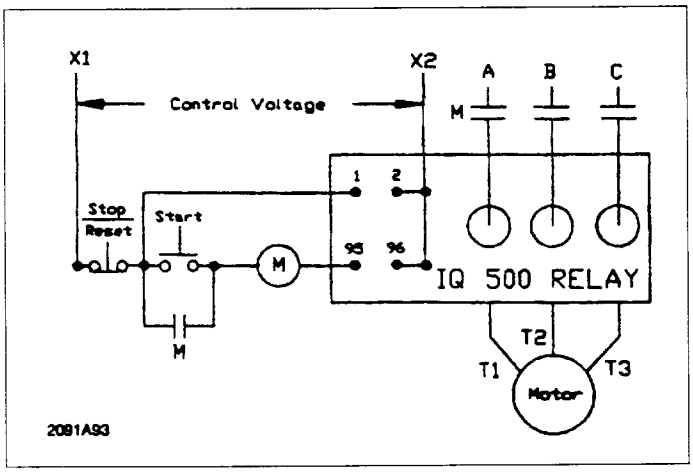

Fig. 4 IQ-500 Relay External Reset Connections

NOTE: If manual reset has been chosen, switch Position 7 will permit electrical reset when in the ON position. Electrical reset will occur with Position 8 of DIP 1 OFF and Position 7 of DIP 2 ON. Electrical reset connections are shown in Figure 4.

Frequency – Position 8 of DIP switch 2 is used to select the frequency of the power circuit being monitored.

Line Frequency	Setting for Position 8
60 Hz	0
50 Hz	1

NOTE: Frequency must be selected before power-up.

⚠ WARNING

2.2 WIRING – INSURE THAT INCOMING AC POWER AND ALL SEPARATE POWER SOURCES ARE TURNED *OFF* AND LOCKED OUT BEFORE PERFORMING ANY WORK ON AN IQ-500 RELAY OR ITS ASSOCIATED EQUIPMENT. FAILURE TO OBSERVE THIS PRACTICE MAY RESULT IN SEVERE INJURY, DEATH, AND/OR EQUIPMENT DAMAGE.

The terminal block on an IQ-500 relay is a plug-in block. It can be removed to make wiring easier. Connect the incoming control power to the terminals marked X1 and X2. The wires must be copper only, and must not be larger than No. 14 AWG. Larger wires will not connect properly. The protective functions of an IQ-500 relay control the trip and alarm relays, as described in Section 3.0. DIP switch settings, listed in Section 2.1, will determine if and when the trip and alarm relays will be energized.

All wiring must conform to applicable federal, state and local codes.

2.3 Mounting – An IQ-500 device is supplied for panel mounting (see Fig. 5 for dimensions). The IQ502 can be converted to mount on a Class A201 Size 1 or 2 contactor. Simply remove the metal mounting bracket from the relay base, rotate it 180 degrees, and reattach it to the relay base. Attach the mounting bracket to the contactor using the hardware included with the relay. The IQ504 can be converted to mount on a Class A201 Size 3 or 4 contactor by attaching the bracket provided.

2.4 Start-up – Before applying power to an IQ-500 device perform the following:

1. Verify that the incoming AC power to the system is disconnected. Also, if other power sources (such as may be wired to the trip and alarm relays) are wired into the panel, verify that these sources are turned OFF and locked out.

2. Verify that all DIP switches are set according to the correct position for the application.

3. Verify that all wiring is correct.

Apply power and check the status LED. The status LED should continually flash green within 5 seconds to indicate the unit is operating properly. If the LED is red, refer to Section 3.2 (LED Indications). If the LED does not light at all, or if the pattern is not described in Section 3.2, refer to Section 4.2 Troubleshooting.

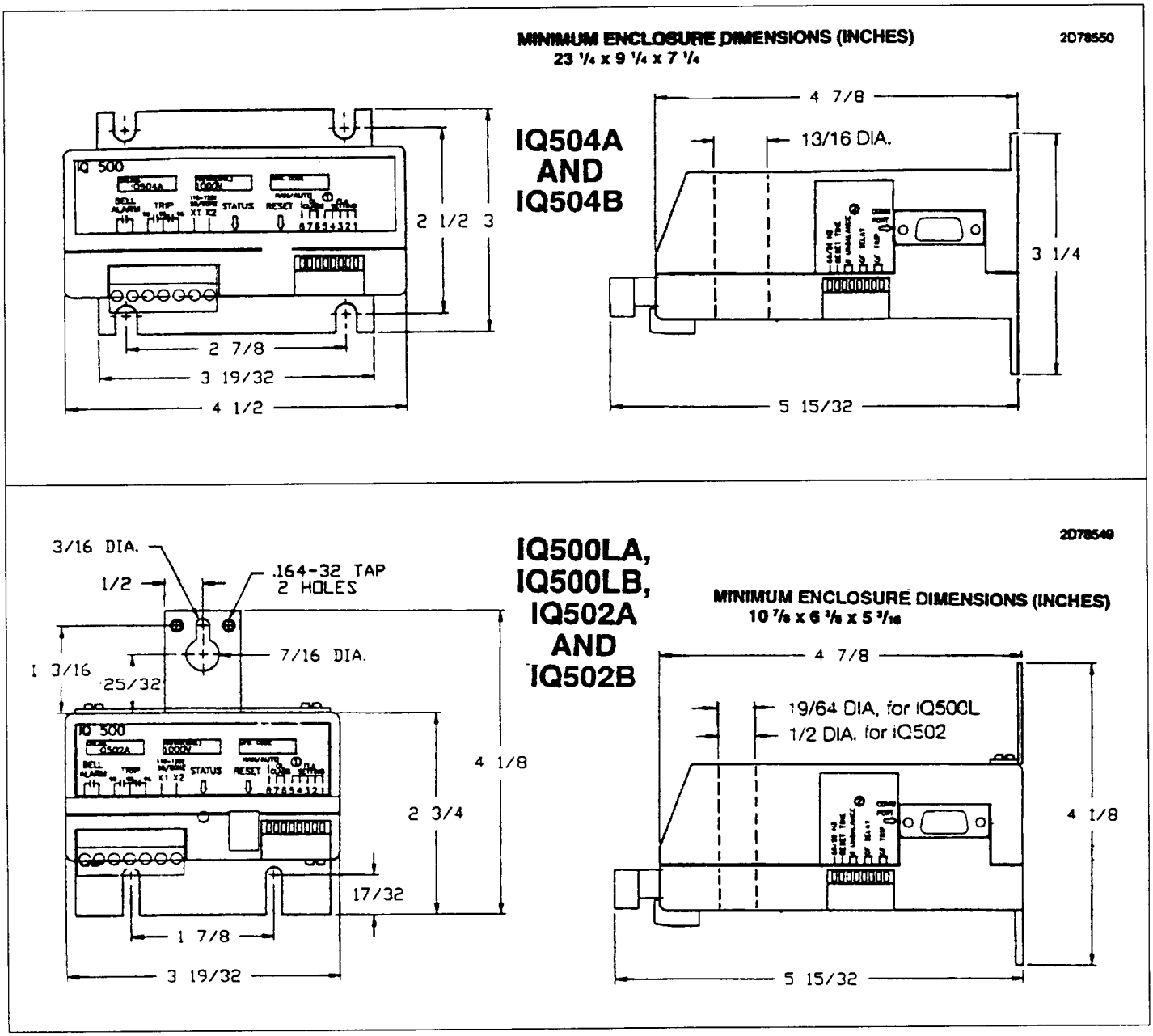

Fig. 5 Outline and Mounting Dimensions (dimensions in inches)

CHARACTERISTICS

3.1 Status LED Indication – The LED on the relay marked STATUS is used for four indications. This LED changes color and its pattern of flashing depending on various conditions:

LED Color	Flashing Pattern	Indication
Green	Continuous ON-OFF Pulse	Normal Operation
Red	Continuous ON-OFF Pulse	Phase-Unbalance Trip
Red	Double ON-OFF Pulse at intervals	Ground-Fault Trip
Red	Constant ON	Overload Trip

NOTE: The alarm relay output will follow the same flashing pattern.

3.2 IQ500 – This is a special functions module which plugs into and attaches to an IQ-500 relay. If communications are used in conjunction with the module, the PONI module is mounted over the IQ500M after the DIP switch settings are made. Both modules are held in place by two retaining screws, one in the upper left-hand comer and the other in the lower right-hand comer.

The IQ500M module provides three special functions: Jam, Underload and Long Acceleration. It is possible to program the module to give either a special-function-trip-only or a special-function trip **and** a main-relay trip in response to a special-function trip condition.

The module has four eight-position DIP switches (DIP 3 through DIP 6 — Refer to Figure 6), two Form C relay outputs①, and two LEDs②. Program the IQ500M module before it is attached to an IQ-500 device. The DIP switches are shipped with all switches in the OFF condition, which is with the lever away from the position numbers. To turn a switch to the ON condition slide the lever toward the position number. Be sure that Position 8 of DIP switch 5 is OFF. If Position 8 is ON, all other settings on the IQ500M module are changed to work as load control.

3.2.1 Underload – The underload protection function has a programmable trip level and trip delay. The underload protection function has trip-level settings of 20% to 76% of the selected overload trip current which permits setting its pickup value just above the individual motor no-load current. Whenever the line current falls below this trip level, the module will trip. The underload start delay allows a .5 to 30 seconds delay upon initial start before declaring an underload trip. The underload trip delay will require the underload condition to be desired.

3.2.2 Long Acceleration Time – The long acceleration function has programmable allowed motor acceleration times of 12 to 68 seconds. If this feature is used, its setting must be greater than the overload class selected. The long acceleration function modifies the overload trip curve during motor acceleration only. The normal overload curve provides safe running protection. With the long acceleration feature, the unit can be programmed to provide close overload protection and still allow only the additional time needed to get the motor and load combination up to full speed. If the long acceleration function is selected, the reset time for an overload trip will be approximately ten times the long acceleration setting. The long acceleration time feature can also be unselected if it is not desired.

3.2.3 Jam – The jam protection function has a programmable trip level, trip delay and start delay. The jam protection function provides a trip when the current exceeds a preset value at any time after the motor has accelerated to rated speed. The jam protection feature operates only when the running current exceeds its trip level, which is programmable between 75% and 440% of the reference (selected trip) current. The jam start-delay allows a .5 to 30 seconds delay before declaring a trip upon initial start. The jam trip-delay will require the trip condition to exist for a selected 0 to 3.5 seconds before declaring a trip. This feature will detect a jam condition on any of the three phases. The jam protection function can also be unselected if it is not desired.

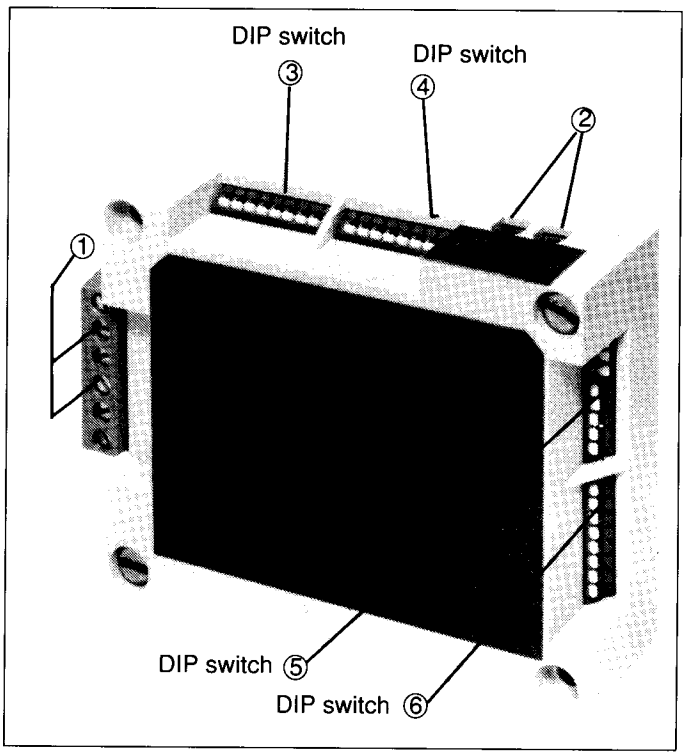

Fig. 6 IQ500M Special Function Module

IQ500M SETTINGS

3.2.4 DIP Switch 3 Settings – DIP switch 3, located at top left of the IQ500M module, is used to program the following features:

3.2.4.1 Underload Trip Level – Positions 4 through 1 are used to select the underload trip level as a percentage of the reference (overload trip) current selected.

UNDERLOAD TRIP LEVEL
DIP SWITCH 3
1 = ON & 0 = OFF
SETTINGS BASED ON PERCENT OF REFERENCE (OVERLOAD TRIP) CURRENT

Trip Level	Setting for Position 4	Setting for Position 3	Setting for Position 2	Setting for Position 1
Inhibited	0	0	0	0
20%	0	0	0	1
24%	0	0	1	0
28%	0	0	1	1
32%	0	1	0	0
36%	0	1	0	1
40%	0	1	1	0
44%	0	1	1	1
48%	1	0	0	0
52%	1	0	0	1
56%	1	0	1	0
60%	1	0	1	1
64%	1	1	0	0
68%	1	1	0	1
72%	1	1	1	0
76%	1	1	1	1

3.2.4.2 Long Acceleration Time – This value is set by Positions 8 through 5 of DIP switch 3.

LONG ACCELERATION TIME
DIP SWITCH 3
1 = ON & 0 = OFF

Permissible Acceleration Time	Setting for Position 8	Setting for Position 7	Setting for Position 6	Setting for Position 5
Inhibited	0	0	0	0
12 sec.	0	0	0	1
16 sec.	0	0	1	0
20 sec.	0	0	1	1
24 sec.	0	1	0	0
28 sec.	0	1	0	1
32 sec.	0	1	1	0
36 sec.	0	1	1	1
40 sec.	1	0	0	0
44 sec.	1	0	0	1
48 sec.	1	0	1	0
52 sec.	1	0	1	1
56 sec.	1	1	0	0
60 sec.	1	1	0	1
64 sec.	1	1	1	0
68 sec.	1	1	1	1

3.2.5 DIP Switch 4 Settings – DIP switch 4 is located at the top right of the IQ500M module. This DIP switch is used to set the jam trip level. Settings are shown in Table D. The trip level is a percentage of the reference (overload trip) current selected.

TABLE D: JAM TRIP LEVEL
DIP SWITCH 4, POSITIONS 8 THROUGH 1
FROM LEFT TO RIGHT
1 = ON & 0 = OFF
SETTINGS BASED ON PERCENT OF REFERENCE
(OVERLOAD TRIP) CURRENT

Jam Trip Setting	Setting Position (87654321)	Jam Trip Setting	Setting Position (87654321)
Inhibited	00000000		
75%	00010100	200%	10110000
80%	00011010	210%	10110111
85%	00100000	220%	10111010
90%	00100111	230%	10111101
95%	00101101	240%	11000000
100%	00110011	250%	11000100
105%	00111001	260%	11000111
110%	01000000	270%	11001010
115%	01000110	280%	11001101
120%	01001100	290%	11010000
125%	01010010	300%	11010011
130%	01011001	310%	11010110
135%	01011111	320%	11011001
140%	01100101	330%	11011100
145%	01101011	340%	11100000
150%	01110010	350%	11100011
155%	01111000	360%	11100110
160%	01111110	370%	11101001
165%	10000100	380%	11101100
170%	10001011	390%	11101111
175%	10010001	400%	11110010
180%	10010111	410%	11110101
185%	10011101	420%	11111001
190%	10100100	430%	11111100
195%	10101010	440%	11111111

3.2.6 DIP Switch 5 Settings – DIP switch 5 is located on the upper right side of the IQ500M module. It is used to program the underload start delay, underload trip delay and the nullifying function.

3.2.6.1 Underload Start Delay – The underload start delay is programmed using Positions 4 through 1.

UNDERLOAD START DELAY
DIP SWITCH 5
1 = ON & 0 = OFF

Underload Start Delay	Setting for Position 4	Setting for Position 3	Setting for Position 2	Setting for Position 1
0.5 sec.	0	0	0	0
2.0 sec.	0	0	0	1
4.0 sec.	0	0	1	0
6.0 sec.	0	0	1	1
8.0 sec.	0	1	0	0
10.0 sec.	0	1	0	1
12.0 sec.	0	1	1	0
14.0 sec.	0	1	1	1
16.0 sec.	1	0	0	0
18.0 sec.	1	0	0	1
20.0 sec.	1	0	1	0
22.0 sec.	1	0	1	1
24.0 sec.	1	1	0	0
26.0 sec.	1	1	0	1
28.0 sec.	1	1	1	0
30.0 sec.	1	1	1	1

3.2.6.2 Underload Trip Delay – Underload trip delay is programmed using Positions 7 through 5.

UNDERLOAD START DELAY
DIP SWITCH 5
1 = ON & 0 = OFF

Underload Start Delay	Setting for Position 7	Setting for Position 6	Setting for Position 5
1 sec.	0	0	0
2 sec.	0	0	1
3 sec.	0	1	0
4 sec.	0	1	1
8 sec.	1	0	0
14 sec.	1	0	1
22 sec.	1	1	0
30 sec.	1	1	1

3.2.6.3 Load Control Position – The switch in Position 8 of DIP switch 5 must be OFF or else the jam and underload settings are nullified. This switch position is turned ON only with load control. See 3.3.

3.2.7 DIP Switch 6 Settings – DIP switch 6 is located in the lower right side of the IQ500M module. It is used to program the jam start delay, the jam trip delay and the relay control feature.

3.2.7.1 Jam Start Delay – The jam start delay Is programmed using Positions 4 through 1.

JAM START DELAY
DIP SWITCH 6
1 = ON & 0 = OFF

Jam Start Delay	Setting for Position 4	Setting for Position 3	Setting for Position 2	Setting for Position 1
0.5 sec.	0	0	0	0
2 sec.	0	0	0	1
4 sec.	0	0	1	0
6 sec.	0	0	1	1
8 sec.	0	1	0	0
10 sec.	0	1	0	1
12 sec.	0	1	1	0
14 sec.	0	1	1	1
16 sec.	1	0	0	0
18 sec.	1	0	0	1
20 sec.	1	0	1	0
22 sec.	1	0	1	1
24 sec.	1	1	0	0
26 sec.	1	1	0	1
28 sec.	1	1	1	0
30 sec.	1	1	1	1

3.2.7.2. Jam Trip Delay – Jam trip delay is programmed using Positions 7 through 5 of DIP switch 6.

JAM TRIP DELAY
DIP SWITCH 6
1 = ON & 0 = OFF

Jam Trip Delay	Setting for Position 7	Setting for Position 6	Setting for Position 5
None	0	0	0
0.5 sec.	0	0	1
1.0 sec.	0	1	0
1.5 sec.	0	1	1
2.0 sec.	1	0	0
2.5 sec.	1	0	1
3.0 sec.	1	1	0
3.5 sec.	1	1	1

3.2.7.3 Relay Control – This feature is programmed by Position 8. It permits separation or merger of the special-function trip signals. If the switch in Position 8 is OFF, then upon a module-trip condition, only the IQ500M

module and its LED will operate. If the switch is ON, then with a module-trip condition both the IQ 500M module and the IQ-500 relay will operate. The module is reset either manually or automatically. If automatically reset then the time is either 10 seconds or 90 seconds.

3.2.8 IQ500M LEDs – The IQ500M LEDs are found on the front of the unit. They are labeled UNDERLOAD for underload trip and JAM for jam trip. The LEDs have the following meanings:

LED Pattern	Meaning
Constant ON	Normal Operation
Constant OFF	Trip Condition or Unselected

3.3 Load-Control Feature – This feature is used to control the motor in a remote branch circuit which contributes to the loading of the branch circuit being monitored. There is a special label included with the IQ500M module that must be positioned over the existing label on the module if load control is used. This new label is necessary since most of the DIP switch settings take on new meanings. Only the Long Acceleration Time settings remain unchanged.

The load-control function can direct a remote motor to stop and restart based on a percentage of the selected overload trip current in the branch circuit being monitored. There are four programmable parameters associated with the load-control feature. These are load-shed level, load-resume level, Load-Shed time-delay and load-resume time-delay. These parameters combine to specify the conditions under which the remote load is shed and restored.

3.3.1 Load-Resume Level – Use Positions 4 through 1 of DIP switch 3 to select the load-resume level. Positions 8 through 5 still control long acceleration. The load-resume level is expressed as a percentage of the reference (overload trip) current.

LOAD-RESUME LEVEL
DIP SWITCH 3
1 = ON & 0 = OFF
SETTINGS BASED ON PERCENT OF REFERENCE (OVERLOAD TRIP) CURRENT

Load Resume Setting	Setting for Position 4	Setting for Position 3	Setting for Position 2	Setting for Position 1
Inhibited	0	0	0	0
20%	0	0	0	1
24%	0	0	1	0
28%	0	0	1	1
32%	0	1	0	0
36%	0	1	0	1
40%	0	1	1	0
44%	0	1	1	1
48%	1	0	0	0
52%	1	0	0	1
56%	1	0	1	0
60%	1	0	1	1
64%	1	1	0	0
68%	1	1	0	1
72%	1	1	1	0
76%	1	1	1	1

3.3.2 Load-Shed Level – Positions 8 through 1 of DIP switch 4 are used to select the load-shed level as a percentage of the reference (overload trip) current. See Table E.

TABLE E: LOAD-SHED LEVELS
DIP SWITCH 4, POSITIONS 8 THROUGH 1
FROM LEFT TO RIGHT
1 = ON & 0 = OFF
SETTINGS BASED ON PERCENT OF REFERENCE (OVERLOAD TRIP) CURRENT

Load-shed Level	Position (87654321)	Load-shed Level	Position (87654321)
Inhibit	00000000		
75%	00010100	200%	10110000
80%	00011010	210%	10110111
85%	00100000	220%	10111010
90%	00100111	230%	10111101
95%	00101101	240%	11000000
100%	00110011	250%	11000100
105%	00111001	260%	11000111
110%	01000000	270%	11001010
115%	01000110	280%	11001101
120%	01001100	290%	11010000
125%	01010010	300%	11010011
130%	01011001	310%	11010110
135%	01011111	320%	11011001
140%	01100101	330%	11011100
145%	01101011	340%	11100000
150%	01110010	350%	11100011
155%	01111000	360%	11100110
160%	01111110	370%	11101001
165%	10000100	380%	11101100
170%	10001011	390%	11101111
175%	10010001	400%	11110010
180%	10010111	410%	11110101
185%	10011101	420%	11111001
190%	10100100	430%	11111100
195%	10101010	440%	11111111

3.3.3 Load-Resume Delay – Positions 7 through 1 of DIP switch 5 are used to select the load-shed delay time. This parameter is programmed as shown in Table F.

3.3.4 Load-Control ON/OFF Switch – The switch in Position 8 of DIP switch 5 must be ON or the load control settings are nullified.

3.3.5 Load-Shed Delay – Positions 7 through 1 of DIP switch 6 are used to select the load-resume delay time. This parameter is programmed as shown in Table G.

TABLE F: LOAD-RESUME DELAY
DIP SWITCH 5, POSITIONS 7 THROUGH 1
FROM LEFT TO RIGHT
1 = ON & 0 = OFF
SETTINGS SELECT TIME-DELAY IN SECONDS

Sec.	Position (7654321)	Sec.	Position (7654321)
0	0000000	32	1000000
1	0000010	33	1000010
2	0000100	34	1000100
3	0000110	35	1000110
4	0001000	36	1001000
5	0001010	37	1001010
6	0001100	38	1001100
7	0001110	39	1001110
8	0010000	40	1010000
9	0010010	41	1010010
10	0010100	42	1010100
11	0010110	43	1010110
12	0011000	44	1011000
13	0011010	45	1011010
14	0011100	46	1011100
15	0011110	47	1011110
16	0100000	48	1100000
17	0100010	49	1100010
18	0100100	50	1100100
19	0100110	51	1100110
20	0101000	52	1101000
21	0101010	53	1101010
22	0101100	54	1101100
23	0101110	55	1101110
24	0110000	56	1110000
25	0110010	57	1110010
26	0110100	58	1110100
27	0110110	59	1110110
28	0111000	60	1111000
29	0111010	61	1111010
30	0111100	62	1111100
31	0111110	63	1111110

TABLE G: LOAD-SHED DELAY
DIP SWITCH 6, POSITIONS 7 THROUGH 1
FROM LEFT TO RIGHT
1 = ON & 0 = OFF
SETTINGS SELECT TIME-DELAY IN SECONDS

Sec.	Position (7654321)	Sec.	Position (7654321)
0	0000000	32	1000000
1	0000010	33	1000010
2	0000100	34	1000100
3	0000110	35	1000110
4	0001000	36	1001000
5	0001010	37	1001010
6	0001100	38	1001100
7	0001110	39	1001110
8	0010000	40	1010000
9	0010010	41	1010010
10	0010100	42	1010100
11	0010110	43	1010110
12	0011000	44	1011000
13	0011010	45	1011010
14	0011100	46	1011100
15	0011110	47	1011110
16	0100000	48	1100000
17	0100010	49	1100010
18	0100100	50	1100100
19	0100110	51	1100110
20	0101000	52	1101000
21	0101010	53	1101010
22	0101100	54	1101100
23	0101110	55	1101110
24	0110000	56	1110000
25	0110010	57	1110010
26	0110100	58	1110100
27	0110110	59	1110110
28	0111000	60	1111000
29	0111010	61	1111010
30	0111100	62	1111100
31	0111110	63	1111110

3.3.6 Relay Control – This feature is programmed by Position 8 of DIP switch 6. It permits separation or merger of the special function trip signals when the IQ500M is not used for load control. If the position 8 switch is OFF then upon a module-trip condition, only the IQ500M module and its LED will operate. If Position 8 is ON, then with a module-trip condition both the IQ500M module and the IQ-500 relay will operate. The Relay Control Setting has no effect when position 8 of DIP switch 5 is ON to select Load Control.

MAINTENANCE

4.0 General – Read the manual to become familiar with the hardware, installation and start-up procedures to be thoroughly familiar with the IQ-500 relay and special function module.

WARNING

ALL MAINTENANCE PROCEDURES MUST BE PERFORMED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE IQ-500 AND THE ASSOCIATED AC LINES BEING MONITORED. FAILURE TO OBSERVE THIS CAUTION CAN RESULT IN SERIOUS OR EVEN FATAL INJURY AND/OR EQUIPMENT DAMAGE.

The following procedures may at times involve working in equipment areas where the hazard of electrical shock is present because live parts are exposed. Personnel must exercise extreme caution to avoid injury.

Always disconnect and lock out the AC power source before touching an IQ-500. Failure to do so can result in serious or even fatal injury and/or equipment damage.

4.1 Troubleshooting – See Table H.

4.2 Unit Replacement – Follow this procedure to replace an IQ-500 relay.

Step 1 – Remove AC power at the main disconnect or isolation switch of the line being monitored. If the switch is located at a distance from the IQ-500 relay, lock it out to guard against personnel accidentally turning it on.

Step 2 – Verify that all separate power sources wired to the relay and its module are de-energized. These may be present on the trip and alarm contacts.

Step 3 – Before disconnecting any wires from the unit, make sure they are individually identified to assure that reconnection will be correctly performed.

Step 4 – Record the position settings of the DIP switches so that the replacement unit can be easily programmed.

Step 5 – Remove the unit.

Step 6 – Refer to Section 3.0 to install replacement unit.

TABLE H: TROUBLESHOOTING

Symptom	Probable Cause(s)	Solution
General Confusion	Incorrect settings	Verify all DIP switch settings
All LEDs OFF	Incoming AC deficient	Verify that proper control voltage exists between X1 and X2 terminals
	Loose connections	Verify that all connections are correct and tight
	Internal restraint	Push reset button
Jam, underload, and long acceleration not working	Incorrect DIP switch setting	Verify switch #8 on DIP 5 is turned OFF
Base relay does not trip on jam or underload	Incorrect DIP switch setting for module/relay trip	Verify switch #8 on DIP 6 is turned On for "both trip"
Load control not working correctly	Unit not in load control mode	Verify switch #8 on DIP 5 is turned ON for load control
	Incompatible DIP switch settings	Load-resume level must be set below load-shed level
Unit trips on acceleration	Long acceleration or overload class setting is too low	Long acceleration time must be set greater than the overload class
Unfamiliar LED pattern	Variety of causes	Reference Sec. 3.1 and 3.2.8 for LED indications. Then check system for cause of fault
Unit does not respond to ground-fault current	Use of external CT's	The ground fault cannot be used with external current transformers
Status LED pulses, alternately, 3 or 4 times green and 3 or 4 times red, with the alarm relay following the red pattern of the LED	Internal RAM error	Try to manually reset the unit. If the problem persists, replace the unit.

Short Circuit Rating – Suitable for use on a circuit capable of delivering not more than as in Table J below of rms symmetrical amperes, 1000V maximum:

TABLE J: SHORT CIRCUIT RATING

Catalog No.	Short Circuit Current
IQ500LA, IQ500LB	5,000 Amperes
IQ502A, IQ502B	10,000 Amperes
IQ504A, IQ504B	18,000 Amperes