Section 6

STARTUP

6.0 General — This section describes the procedure to follow when applying AC power to an IQ-1000 II, assuming that AC power has never been applied to the unit before. Each step in the procedure is shown below with a box to the immediate left, which may be used as a checklist to reduce the chance of omitting or skipping an item.

DANGER

Only qualified personnel familiar with the IQ-1000 II, the motor starter, and its associated mechanical equipment should perform the startup procedures listed here. Failure to comply can result in serious or fatal injury and/or equipment damage.

CAUTION

The IQ-1000 II is a solid-state device. Do not use a megger or perform high-potential testing on the connections associated with the unit. Failure to comply will result in equipment damage.

6.1 Power Off Checks — With the incoming AC power locked off at the isolation switch, perform these checks:

- ☐ Ensure that the isolation switch feeding the IQ-1000 II is in the OFF position.
- ☐ Ensure that there is no possibility of backfeeding control power through the control transformer, which will result in voltage being present on the primary of the transformer.
- ☐ Ensure that any foreign sources of power, such as those connected at the IQ-1000 II's relays' external terminals. are turned off.
- ☐ Ensure that the wiring associated with the application has been installed properly as shown on the Wiring Plan Drawing which was produced for the application.

6.2 Initial AC Power Checks — The following procedures describe the initial items to be performed when power is first applied to the IQ-1000 II. Refer to Figure 6.1 as necessary.

- ☐ With the power still OFF. disconnect the AC control power line to terminal 4.
- ☐ Connect an AC voltmeter between the wire just disconnected from terminal 4 and terminal 7.
- ☐ Turn AC power on.
- ☐ Measure the voltage and verify that a level of 120 VAC or 240 VAC is applied.

NOTE

If 240 VAC control power is being applied, and Incomplete Sequence option and/or Remote Input option is being used, verify that only 120 VAC will be present across terminals 8 and 9 and terminals 9 and 10. See Paragraph 5.2, **Wiring–General** and Figure 5.11 for additional 240 VAC wiring information.

- ☐ Remove AC power.
- ☐ If the AC power level is correct, reconnect the wire to terminal 4.
- ☐ If the AC power level is incorrect, consult the Wiring Plan Drawing and rewire, as necessary.

6.3 Initial AC Power On — The following procedure describes the initial items to be performed when AC power is first applied to the IQ-1000 II.

- ☐ Place the keyswitch in the Program position.
- ☐ Apply AC power to the application.

The message THINKING is displayed for a few seconds while the IQ-1000 II "initializes". Next, the software version number is displayed. At this time the IQ-1000 II is ready to accept set point values.

NOTE

While THINKING is present on the display, the IQ-1000 II is not protecting the motor. If the unit is in Mode 2, the trip relay contacts will be blocked open for 3 seconds.

DANGER

Do not attempt to enter any values without using the appropriate Set Point Record Sheet. Improper operation and/or personal injury could result if this procedure is not followed. See Section 8 for IQ-1000 II programming information.

- ☐ Enter setpoints as described in Paragraph 4.3. Use the filled-in Set Point Record Sheet (Table 8.B) for the specific application.
- ☐ After entering all setpoints, verify that each entry has been correctly entered as described in Paragraph 4.4.

DANGER

When the keyswitch is placed in the Protection position, the IQ-1000 II's Trip Relay will no longer prevent the motor's main contactor from closing. At this time the motor associated with the application can be started. It is important to ensure that all safety precautions associated with rotating equipment and the associated driven mechanism be taken. Failure to do so can result in serious or fatal injury and/or equipment damage.

- ☐ Ensure that all rotating members and driven mechanisms associated with the application's motor are properly and securely connected and free of any loose or foreign objects.
- ☐ Ensure that all personnel are cleared from the area of the application's motor and driven mechanics.
- ☐ Follow any startup procedures which may accompany the load equipment and refer to the application engineer who developed the Set Point Record Sheet or the associated mechanics if necessary.
- ☐ Turn the keyswitch on the IQ-1000 II to the Protection position. Start the motor using the external start switch or contacts.
- ☐ Using the information supplied by the application engineer or equipment manufacturer, verify that the motor is operating properly.
- ☐ With the motor running, use a clamp-on type ammeter to measure the AC line current on the main motor supply lines.
- ☐ Verify that the I_A, I_B, and I_C currents as measured by the IQ-1000 II are within 15% of the currents as measured by the ammeter (see Paragraph 4.5 for the procedure to monitor motor parameters). This is not meant to verify accuracy of the IQ-1000 II; this procedure is to verify proper wiring of the current transformers and correct setting of the CT ratio. If there is a difference of greater than 15%, either the CT ratio is set incorrectly and/or the current transformers are incorrectly wired.

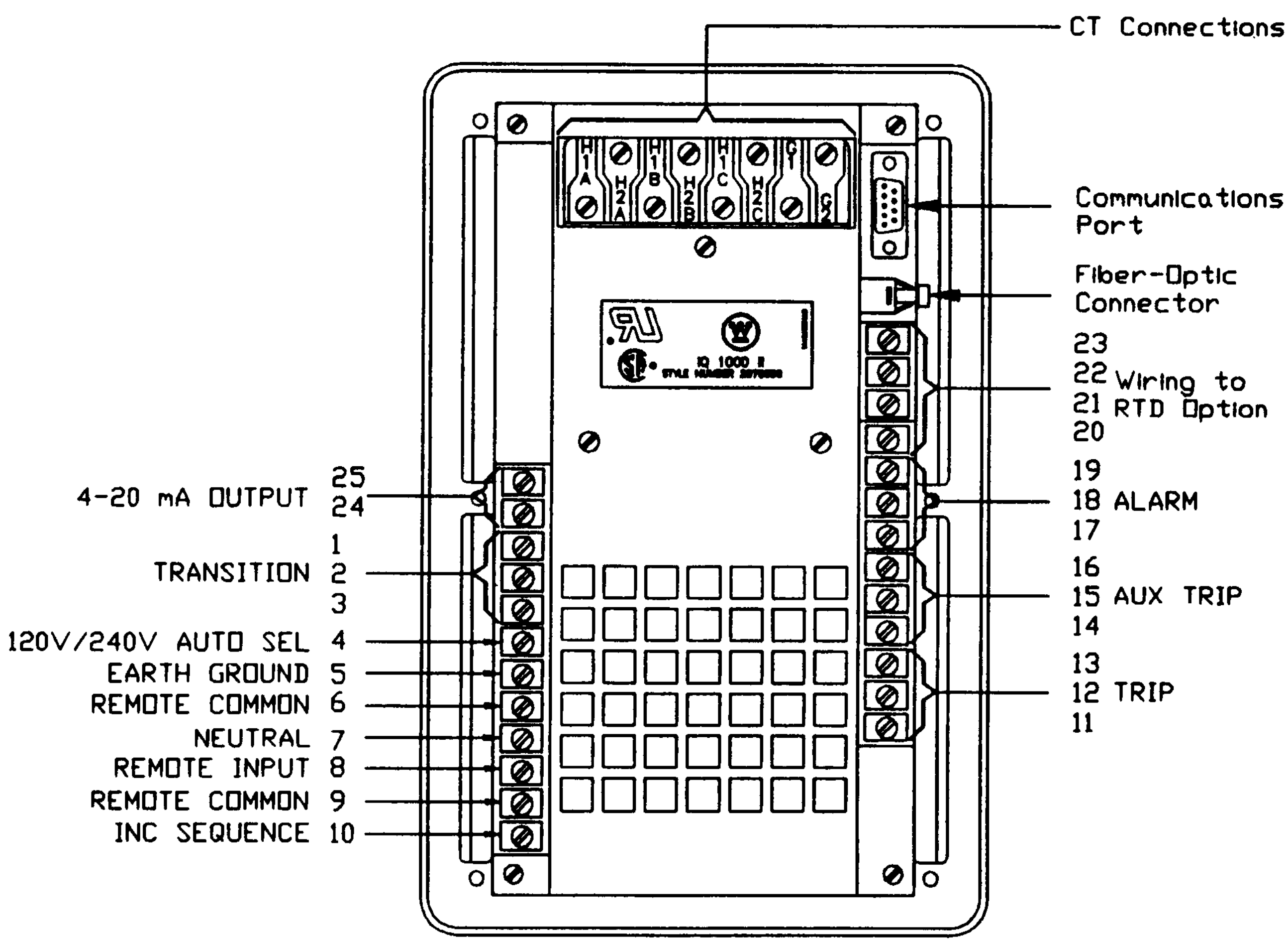


Figure 6.1 — IQ-1000 II Wiring Terminals

Section 7

APPLICATION CONSIDERATIONS

7.0 General — This section describes the protection and control characteristics of the IQ-1000 II, and is intended for the engineer who is responsible for matching the control to an individual application. Information presented here is especially useful for understanding setpoint considerations described in Section 8.

It may be helpful to read Sections 7 and 8 quickly, and then to reread and study Section 7 carefully. After doing so, reread Section 8 in order to select those setpoints from the program menu given in Table 8.B which relate to the specific application.

NOTE

Throughout these explanations when specific functions are discussed, the program menu item number is also noted. This technique will help the reader understand the concept by relating it to Table 8.B, where more details are located.

7.1 Motor Protection — The IQ-1000 II protects the motor, starter, and load in the following ways:

- Motor overload protection
- Overtemperature protection
- Instantaneous overcurrent protection
- Ground fault protection
- Phase reversal protection
- Motor bearing temperature monitoring
- Jam protection
- Underload protection
- Load bearing temperature monitoring
- Incomplete sequence protection

7.1.1 Overload Protection without RTDs — The motor overload protection feature, called the I^2T algorithm, calculates the rotor temperature of the motor based on the amount of current flowing into the motor. If no RTDs are present, the IQ-1000 II will proceed toward a trip only when the average current level of the 3 phases is above the ultimate trip level. A programmable I^2T alarm (program menu item 20) informs the user when the IQ-1000 II is between 60% and 100% of the way to a trip.

The overload trip set point is determined as the maximum amount of I^2T calculated by the IQ-1000 II which can be translated to the rotor. When the IQ-1000 II has accumulated enough I^2T, a trip occurs and message LRC/I^2T (Locked Rotor/ Thermal Overload) is displayed. **The motor cannot restart until the temperature of the rotor, as calculated by the IQ-1000 II, falls below the alarm level set point entered into the I^2T alarm level function (item 20).** (The algorithm has both a heating and cooling calculation.)

To do this, the IQ-1000 II maintains a short-term history of the motor's operation (see Figure 7.1). The following variables are used as input data for the history:

- Motor current (I_1), the positive sequence current
- Motor current (I_2), the negative sequence, or "unbalanced," current
- Time

This data can be considered as the current feedback from the motor.

In addition to the current feedback from the motor, certain motor constants are needed. They are supplied to the IQ-1000 II when the user-chosen setpoints are programmed into memory. These are:

- Full-load amperes (item 42)
- Locked-rotor current (item 17)
- Maximum allowable stall time (item 18)
- Ultimate trip (item 19)

Using these motor constants, sampled motor currents, and time, the IQ-1000 II can track the calculated rotor temperature, always assuming a 40°C ambient temperature.

7.1.2 Overload Protection with RTDs — The temperature data obtained by employing optional RTDs is used by the IQ-1000 II in the following two ways to protect the motor:

(1) Direct measurement of the winding temperature-versus-programmed trip temperature. (This gives a user-set fixed trip point based on actual, measured stator winding heating and cooling.)

(2) RTD winding temperatures — when combined with the monitored positive/negative sequence motor current and the I^2T algorithm for motor protection — incorporates the anticipated cooling of the rotor based on the actual stator winding temperature. (This is described in more detail in subparagraphs 7.1.3.6 and 7.1.4.)

The following motor input variables are used by the IQ-1000 II when the optional RTDs are used:

- Motor current (I_1), the positive sequence current
- Motor current (I_2), the negative sequence, or "unbalanced," current
- Time
- Stator winding temperature

This data can be considered as the feedback from the motor.

In addition to the variable data, certain motor constants are needed. They are supplied to the IQ-1000 II when these user-chosen setpoints are programmed into memory. These are:

- Full-load amperes (item 42)
- Locked-rotor current (item 17)
- Maximum allowable stall time (item 18)
- Ultimate trip (item 19)
- Winding temperature trip value (item 3)

The IQ-1000 II stores the chosen setpoint levels in its non-volatile memory and accurately measures feedback variables. Thus the unit protects the rotor by using the I^2T algorithm, while the stator is protected by direct measurement through the RTDs.

7.1.3 Protection Curve — The motor protection curve defines the motor-versus-time relationship that is generated by the IQ-1000 II's application software, hardware, and programmed set point values. Note Figure 7.2. Ideally, this curve is located as close as possible to the motor damage curve, thus allowing maximum utilization of the motor without damage.

(The motor damage curve is defined as that point in the relationship between the motor current and time where thermal damage results.)

When the motor current-versus-time relationship exceeds this damage curve, a trip condition occurs, and the motor is turned off.

The IQ-1000 II automatically calculates the correct motor protection curve for a specific application after the following items are entered: full-load amperes rating (item 42); locked-rotor current (item 17); maximum allowable stall time (item 18); and ultimate trip (item 19).

A brief discussion of how these values affect the motor protection curve is given in the following subparagraphs. The typical curve shown in Figure 7.2 is the result of the factors listed in these explanations.

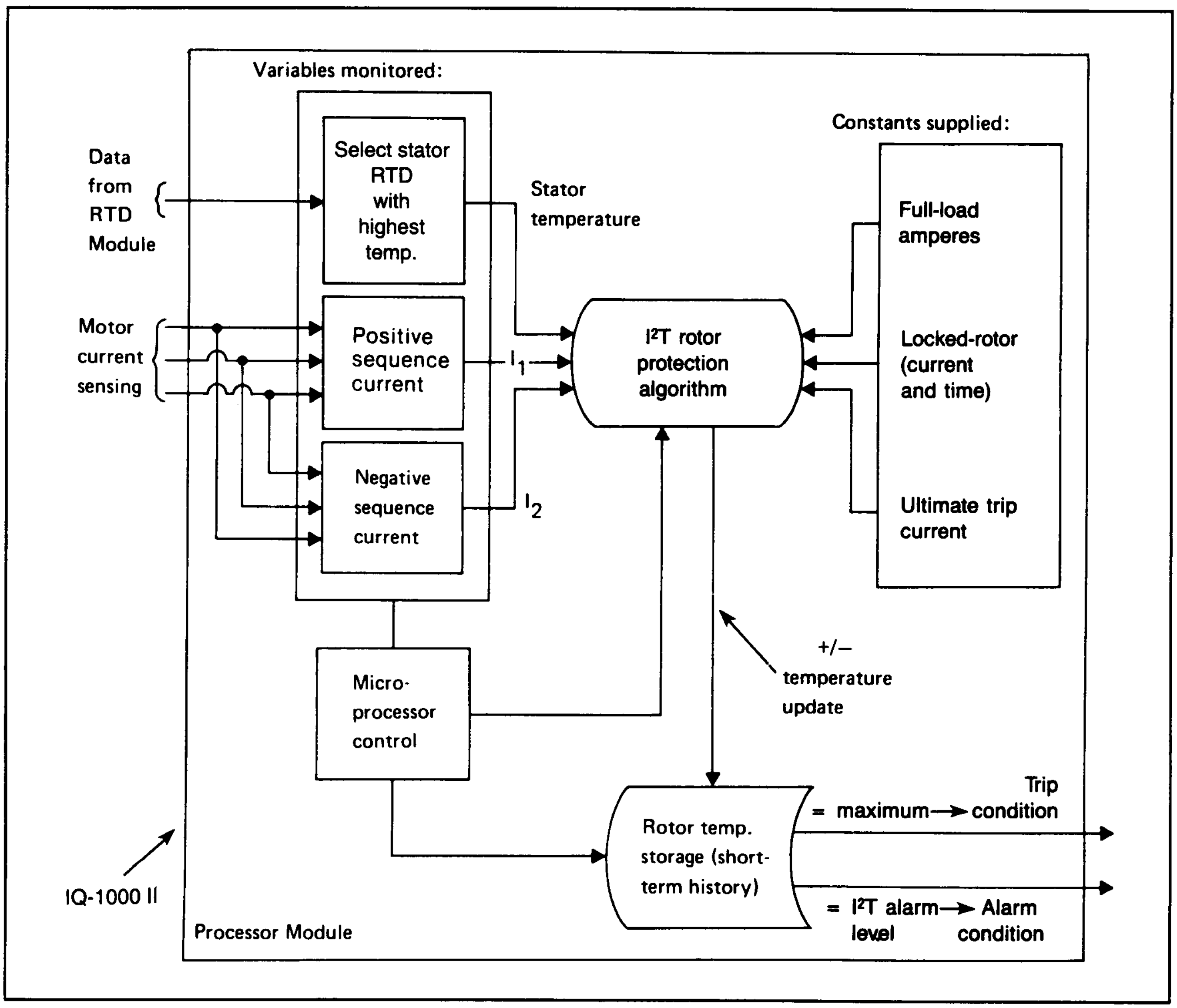


Figure 7.1 — Rotor Temperature Tracking

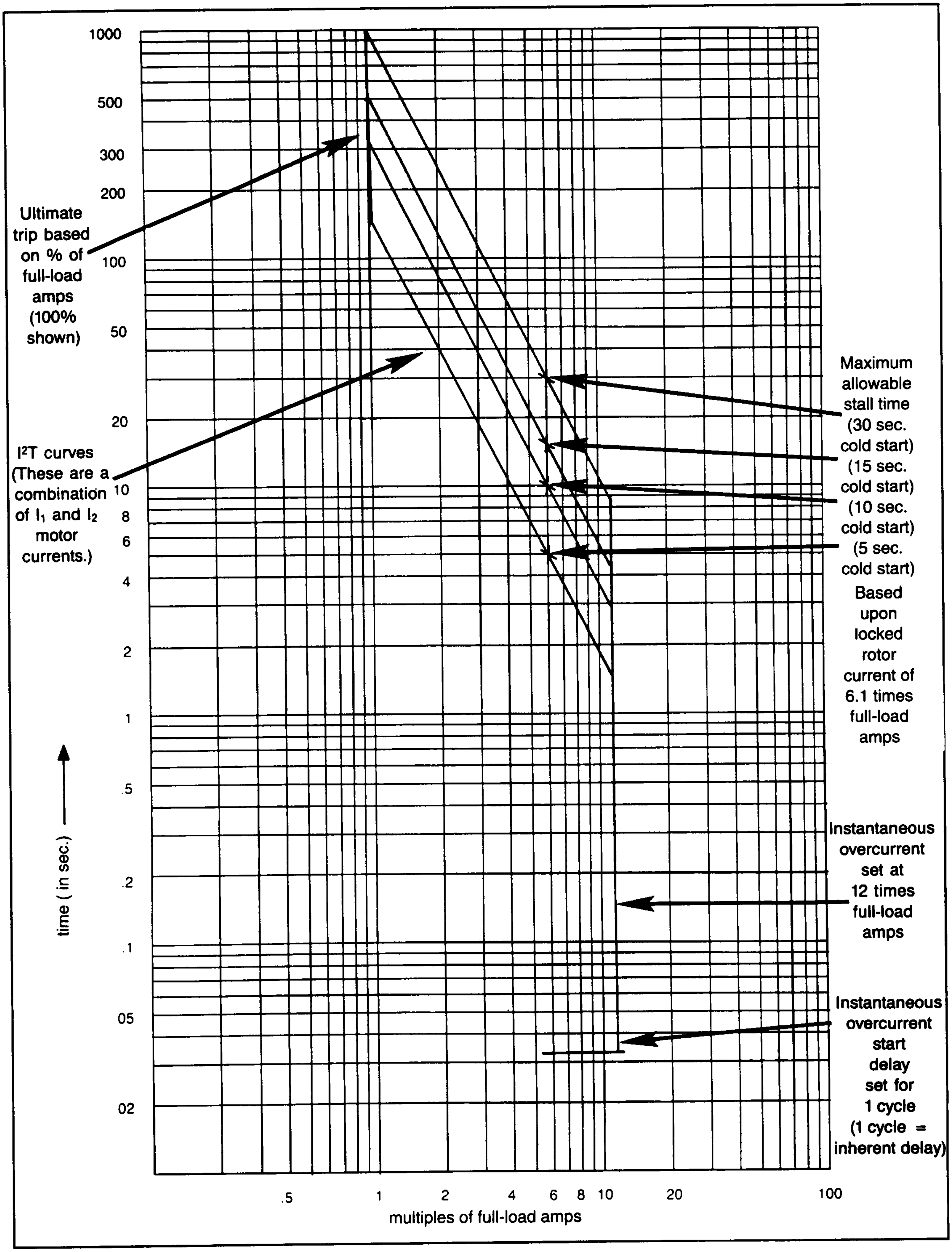


Figure 7.2 — Motor Protection Curve

7.1.3.1 Instantaneous Overcurrent Function—The specific instantaneous overcurrent (item 15) setpoint used in Figure 7.2 is 12 times (1200%) full-load amperes (item 42). In general, the instantaneous overcurrent setpoint for all applications should be at least 1.6 times the locked rotor current ratio. The instantaneous overcurrent setpoint available range is 300 thru 1600% of full-load amperes.

NOTE

For the I.O.C. trip level to be effective, set it below your fuse interrupting rating *or* your contactor withstand capacity.

NOTE

The instantaneous overcurrent start delay function (item 16) has a fixed minimum 1 cycle delay to detect the condition. The available setpoint range for additional start delay is actually 1 thru 20 AC line cycles.

7.1.3.2 Locked-Rotor Function — The family of curves shown in Figure 7.2 is based upon a locked-rotor current set point (item 17) of 6.1 times (610%) the full-load amperes function's (item 42) set point and a variable locked-rotor stall time set point (item 18).

All curves shown in Figure 7.2 are based on a maximum allowable stall time from a cold start. Since the IQ-1000 II's algorithm retains a history of both the operating current and operating time of the motor, it is not necessary to program it for hot starts. The unit automatically takes into consideration whether it is a hot or cold start. The locked-rotor set point, however, should be set for a cold start.

7.1.3.3 Ultimate Trip — The ultimate trip function's (item 19) set point is the lowest value of current above which the motor can be damaged over time. If the motor has a service factor larger than 100%, the ultimate trip level can be increased accordingly. A service factor of 1.25 could be used with a 125% ultimate trip level.

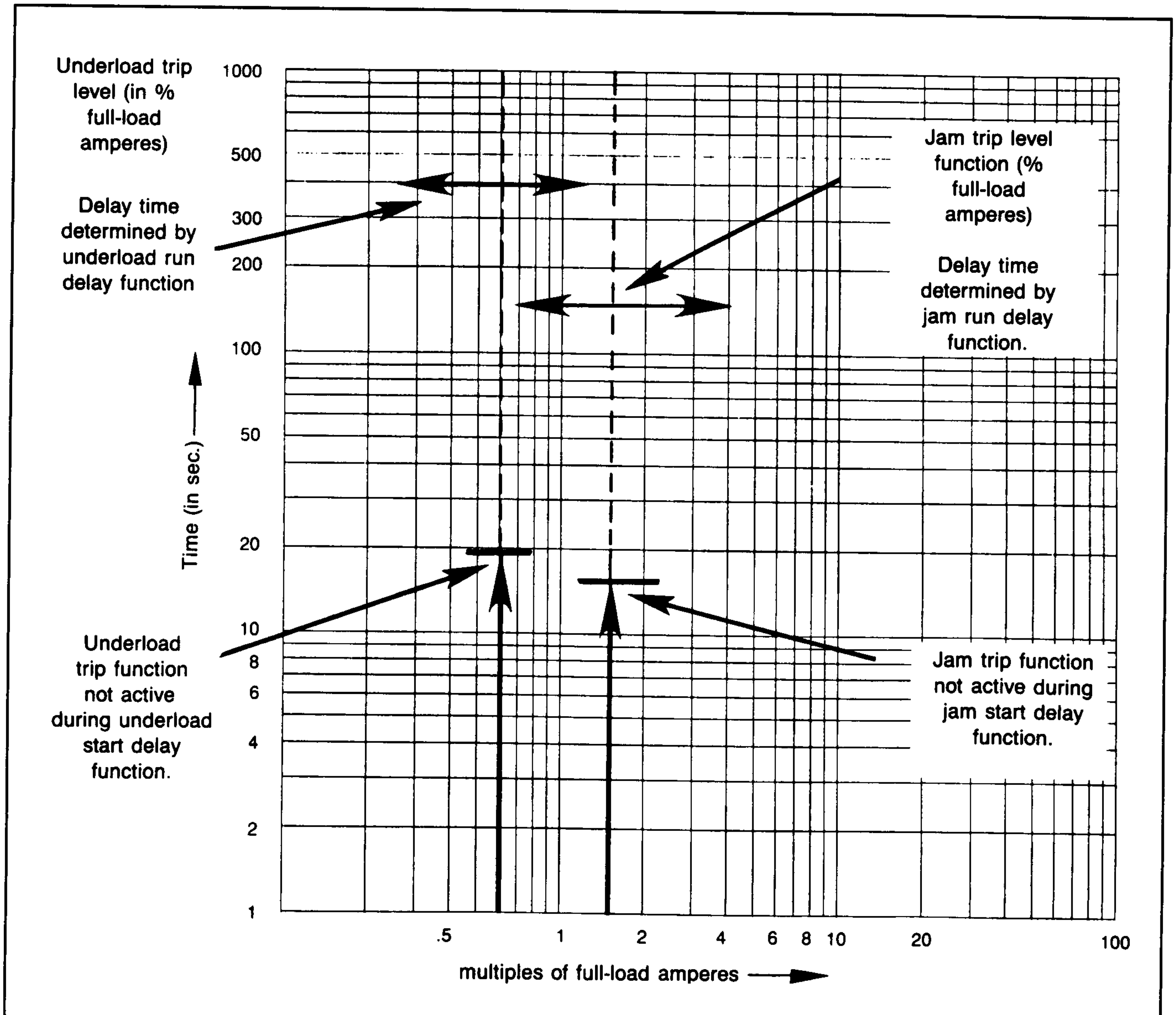


Figure 7.3 — Jam Protection Curve

7.1.3.4 Underload Functions — When the motor is running, a sudden current reduction indicates a malfunction in the driven equipment. If the current level falls below the user-set underload alarm value (item 26), an alarm condition exists. If the current falls below the underload trip level (item 27), a trip condition occurs and the motor is taken off-line.

Underload protection is used in the event of mechanical problems such as a blocked flow in a pump, loss of back pressure in a pump, or a broken drive belt or drive shaft. A programmable start delay (item 28) is provided to lockout the underload function while starting unloaded motors to prevent nuisance tripping. The run delay (item 29) is useful in applications where the motor is operated under light loads for short periods of time such as a conveyer system. To disable the underload trip function, program a value of 0 for item 27. To disable the underload alarm function, program a value of 0 for item 26.

7.1.3.5 Jam Functions — Once the motor is running, if the monitored current level exceeds the set point entered for the jam trip level (item 23), a trip occurs. (See Figure 7.3 in which the jam trip set point is 180% of full-load current.) An alarm level can also be programmed for jam (item 22).

In cases where the RTD Option is used, jam protection is especially desirable with gear train or other mechanical-type loads. In such cases an overload or physical jam could cause damage. A programmable start and run delay are provided to compensate for inrush current and momentary surges in the load.

If the jam trip function (item 23) is not desired, a value of 1200% should be entered along with a start delay of 1 second. (See Paragraph 8.10 for more details.) The jam alarm function can be disabled by programming item 22 for a value of 1200%.

7.1.3.6 Temperature Effects — Motor protection is directly related to the temperature of the rotor. If RTDs are not used, the IQ-1000 II assumes the ambient temperature to be 40°C. Thus the actual ambient temperature has no effect on either the starting or running of the motor.

The customer application engineer should take these factors into consideration and compensate for them if a higher ambient temperature is anticipated. The best solution is to use RTDs since any compensation for a higher ambient temperature results in overprotecting the motor during conditions of lower temperatures.

Without RTDs, the IQ-1000 II calculates the current and time, and then converts them to a calculated stator/rotor temperature. The constant I^2T curve, as established by the locked-rotor current and maximum allowable time functions (items 17 and 18), is assumed to adequately protect the motor for all levels of motor current above the ultimate trip set point level. Should the curve not be adequate to protect the motor due to stator limitations at elevated ambient temperatures, then the use of RTDs is recommended. RTDs allow full utilization of the power available from the motor, and they reduce unnecessary shutdowns.

7.1.4 Typical Motor Protection Curves — To illustrate the IQ-1000 II's protection features, two sample curves are shown. Using specific motor data, typical motor protection curves of the IQ-1000 II without RTDs are shown in Figure 7.4. The use of RTDs is assumed in Figure 7.5. The following data were used:

- Instantaneous overcurrent of 12 times full-load amperes
- Locked-rotor amperes of 6.1 times full-load amperes
- Maximum allowable stall time of 15 seconds, cold start
- Ultimate trip level of 100% of full-load amperes
- Start cycle set at 10 seconds (assumes a single-stage motor). (See items 37 and 38.)
- Motor running; loaded at 90% of full-load amperes
- Underload protection set point is 60% of full-load amperes
- Jam protection functions of 180% full-load amperes for a 5-second delay

The difference in the typical curve caused by the addition of RTDs is shown in Figure 7.5. It centers on the time period after 60 seconds. (When RTDs are used, the actual monitored temperature automatically overrides the ultimate trip function's setpoint.)

Note that the ambient conditions under which the motor is operating affect the top portion of the curve. The curve shifts to the left with increasing ambient temperature, and to the right with decreasing ambient temperature.

The effects of the motor winding temperature (items 3 and 7) setpoints, which can be used with RTDs, are not evident in Figure 7.5. These functions are independent of the effects of temperature on the I^2T algorithm's trip curve. These functions' setpoints are based on the recommended maximum stator temperature, as supplied by the motor manufacturer. Depending upon the specific motor winding temperature setpoints, the temperature trip curve shifts to the left or right.

The IQ-1000 II allows maximum utilization of the power available from the motor by setting its trip conditions as close as possible to the motor damage curve.

7.1.5 Motor Current — The IQ-1000 II monitors both positive and negative sequence currents. Each is described in the following subparagraphs.

7.1.5.1 Negative Sequence Currents — Throughout the discussion of motor protection curves, the effects of negative sequence currents cannot be emphasized too strongly. For maximum motor utilization, the actual load should be matched closely to the full horsepower of the motor. However, when this is done, the effect of motor voltage unbalance — that results in the negative sequence current — becomes more critical.

The IQ-1000 II accurately calculates negative sequence currents in an ongoing manner. It is not necessary for the user to arbitrarily pick a specific set point percent of unbalance to shut the motor down. (However, see program items 30 and 31.) As long as the rotor temperature, as calculated by the IQ-1000 II, does not equal the motor damage curve, the motor continues to operate.

7.1.5.2 Positive Sequence Currents — The IQ-1000 II monitors true RMS motor current. It takes a total of 36 samples in each phase during a 1 cycle period in order to calculate the

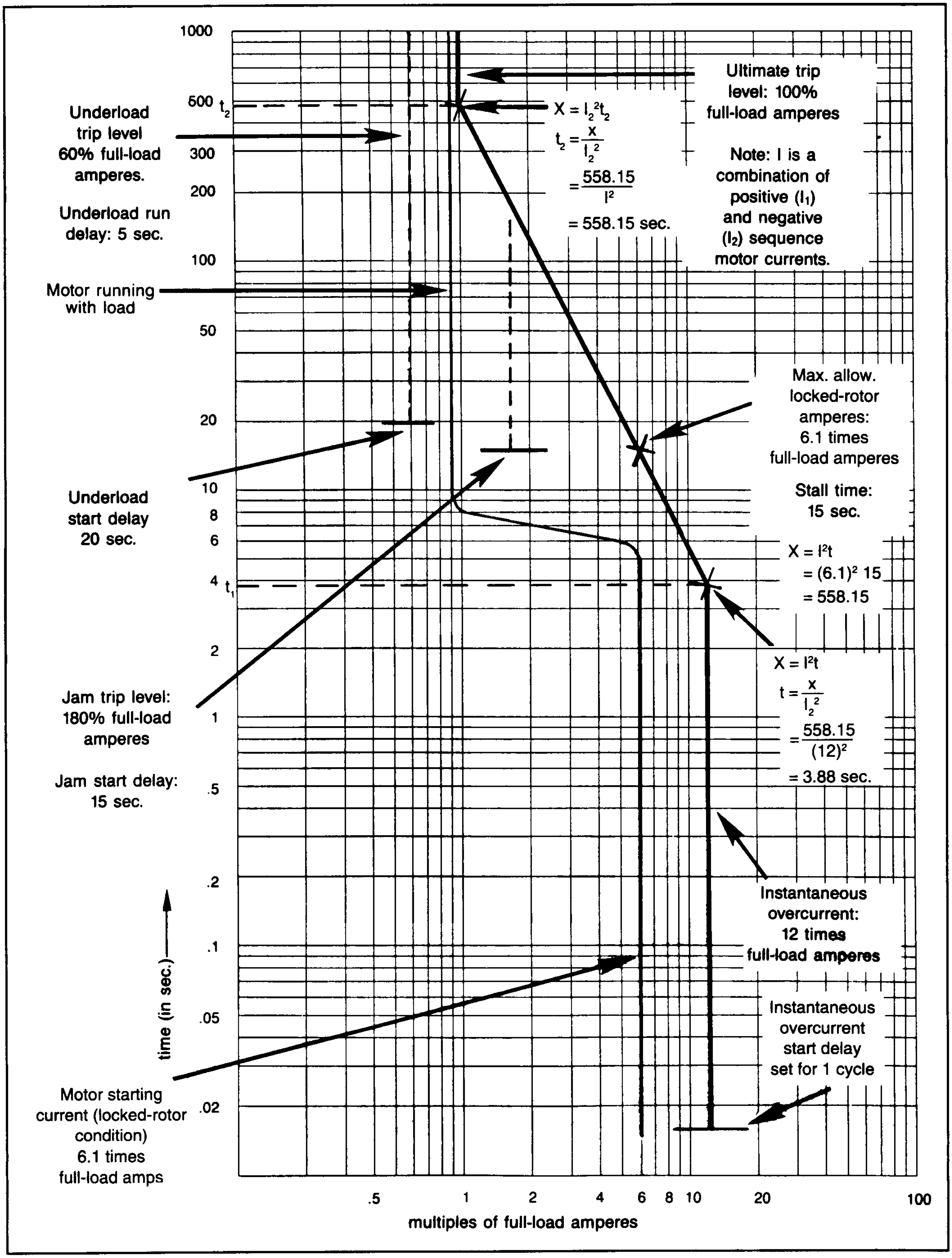


Figure 7.4 — Motor Protection Curve (without RTDs)

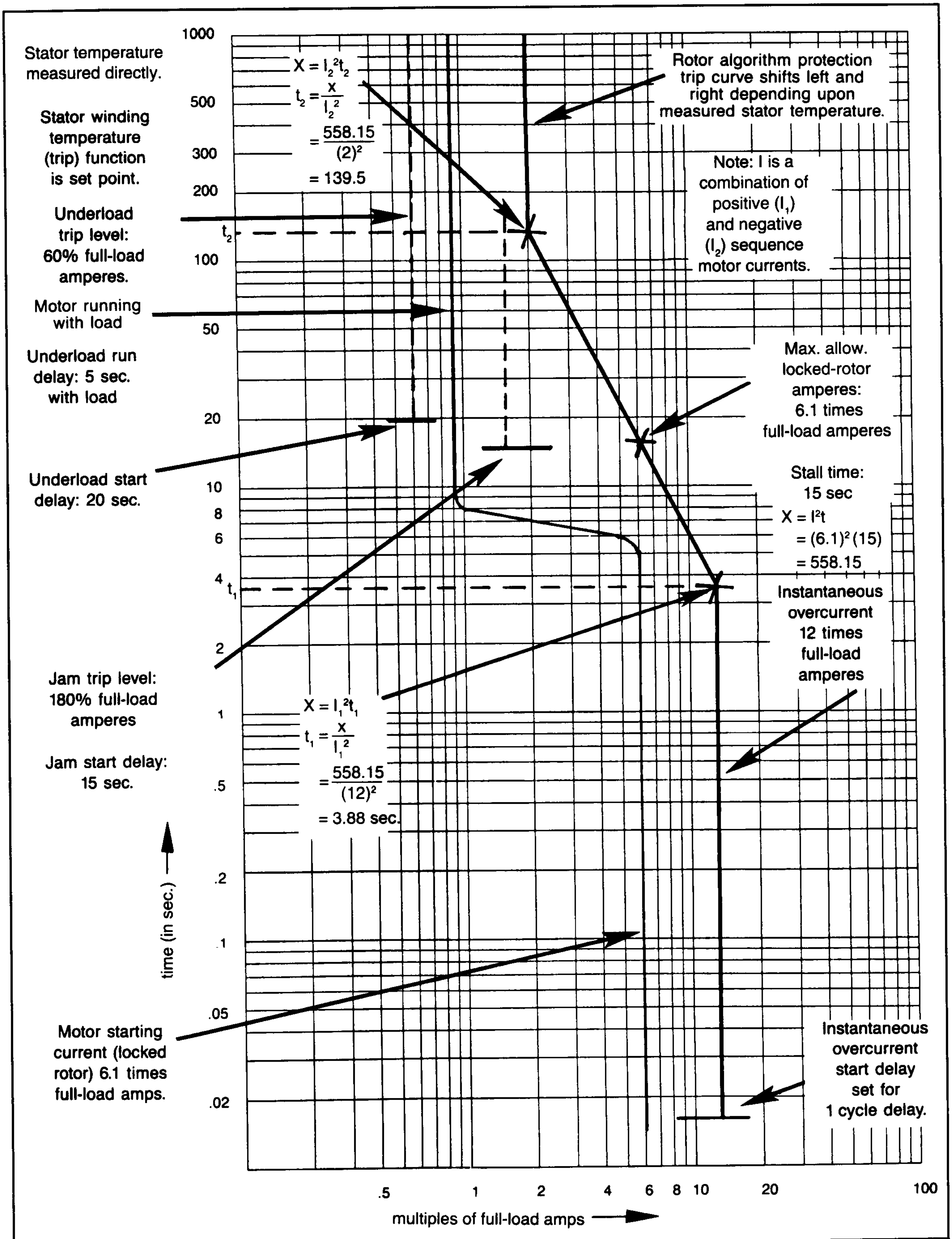


Figure 7.5 — Motor Protection Curve (with RTDs)

positive and negative sequence currents.

The sampling point is constantly shifting; thus the IQ-1000 II also monitors non-sinusoidal wave forms. This is important for applications where power factor correction capacitors and rectified systems are on the same main bus.

7.1.6 Ground Fault Protection — The IQ-1000 II's ground fault function (program menu item 11) provides protection against excessive leakage current levels. (The specific level is chosen by the user.)

Use of this function is restricted to a grounded system; it may not be used in an ungrounded system. The function requires that an optional ground fault (zero sequence) transformer be installed in the grounded system in which the secondary of the main power transformer feeding the motor is wired in a wye grounded configuration.

The optional ground fault transformer chosen must have a current transformer ratio of 50:5 to allow the IQ-1000 II to properly interpret the ground fault current level.

7.2 Motor Cycle Monitoring — As used here, the term "motor cycle monitoring" refers to the IQ-1000 II "passively" monitoring the motor during periods of normal operation. Normal operation includes the start cycle, run cycle, and stop cycle.

The word "passive" implies that the IQ-1000 II monitors motor current levels. It does not actually switch nor directly affect the motor's contactors except when the Transition Relay, described in Paragraph 8.15, is used for reduced voltage starting, or a Trip Relay or Auxiliary Trip Relay is used to take the motor off line in a fault situation.

The following explanations center on the timing associated with motor starting, running, and stopping.

7.2.1 Start Cycle — The relationship between the IQ-1000 II and the motor current level during a start cycle is shown in Figure 7.6.

The motor start cycle is initiated when the motor current exceeds 30% of the full-load amperes setpoint (program menu item 42) assuming the motor was not in a trip condition. At this time the message "START" is displayed and the transition timer begins. The duration of the timer is determined by the motor start transition time (item 38) setpoint, which may be set to 0 seconds to disable the transition function.

The IQ-1000 II will transition if the current falls below the transition set point level (item 37). If a transition does not occur before the transition time expires, the IQ-1000 II will trip or transition at the user's choice. The run cycle begins as soon as the transition takes place. If transition time (item 38) is set to 0, the run cycle will begin immediately or a transition trip will occur, depending on item 39 of Table 8.B.

Once a start is declared, start delay timers will also begin timing, unless they are disabled (start delay timers are de-

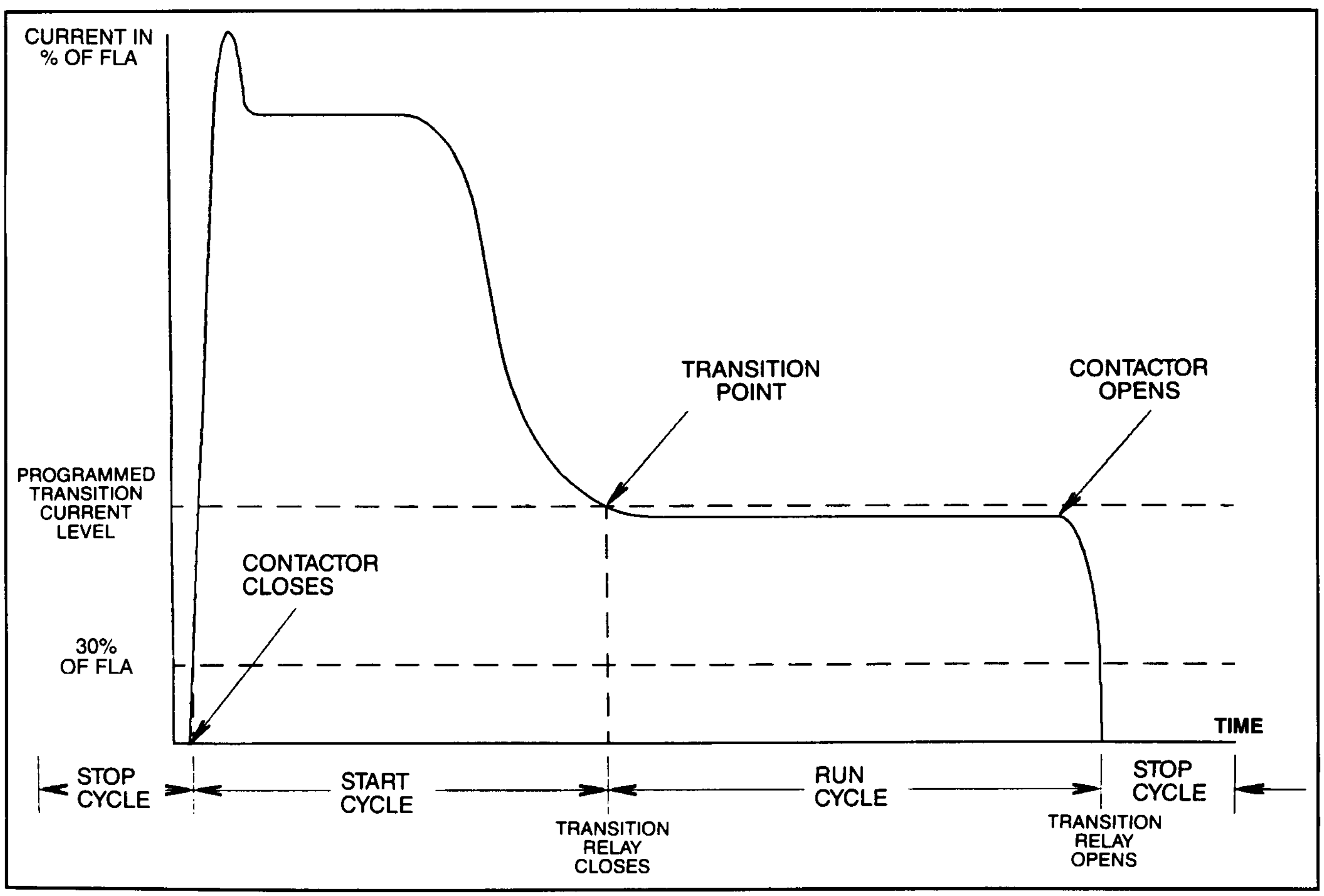


Figure 7.6 — Motor Start and Run Cycles

scribed in Paragraph 8.1.1). This group includes:

- Instantaneous overcurrent start delay timer. (Program menu item 16; described in Paragraphs 8.5.3 and 7.1.3.1.)
- Jam start delay timer. (Program menu item 24; described in Paragraph 8.10.3.)
- Underload start delay timer. (Program menu item 28; described in Paragraphs 8.11.3 and 7.1.3.4.)

Disabling the motor start transition (time) function (item 38) cancels any transition time, but these timers, if used, continue to operate independently of the duration of the start cycle. (See Paragraph 8.15 for details.)

7.2.2 Run Cycle — Once the transition occurs, the motor's run cycle is initiated and the message "RUN" is displayed. The run cycle continues until the monitored motor current level falls below 5% of its full-load amperes setpoint (item 42) at which point a stop is declared and the IQ-1000 II returns to the "READY -- 3" or stop mode. (See Figure 7.6.)

The run cycle is another normal motor operating state. Protection functions with run delays are active in this state once the start delay has expired. The primary function of run delays is to prevent nuisance tripping. These are:

- Ground fault run delay timer. (Program menu item 13; described in Paragraph 8.4.3.)
- Jam run delay timer. (Program menu item 25; described in Paragraphs 8.10.4 and 7.1.3.5.)
- Underload run delay timer. (Program menu item 29; described in Paragraphs 8.11.4 and 7.1.3.4.)
- Phase unbalance alarm run delay timer. (Program menu item 31; described in Paragraph 8.12.2.)

Keep in mind that run delays become enabled only after the start delay for that function has timed out. The actual run delay begins timing only after a transient trip condition occurs. (See Paragraph 8.1.)

7.2.3 Stop Cycle — When the monitored motor current level falls below 5% of the full-load amperes setpoint (program menu item 42), the stop cycle begins. When the IQ-1000 II is in the stop cycle, it can be in the Program mode, Ready mode, or any trip mode.

When the anti-backspin delay time function (item 41) is used, it is initiated along with the stop cycle. The anti-backspin function prevents a start cycle's initiation until the user-selected setpoint time elapses. (The Trip Relay and/or Auxiliary Trip Relay is used in this instance to prevent a motor start. See Paragraph 8.17 for more details.)

A second function also affects the stop cycle. This is the starts per time allowed function (program menu item 33). It prevents a motor from being restarted once the user-selected setpoint, in number of starts per a given time, is reached. (Here again the Trip and/or Auxiliary Trip Relay prevents the restart.) Only when the time allowed for starts count function's setpoint (item 34) has elapsed can a start cycle be initiated (see Paragraph 8.14).

7.3 AC Line Interruptions — The IQ-1000 II operates in a controlled and predictable manner during incoming AC line interruptions. The events flow chart shown in Figure 7.7 lists the predictable events which occur during various AC line interrupts for a typical motor. The chart assumes a complete, or nearly complete, loss of AC line power.

Study the figure and note that at least 3 AC cycles must occur before any of the following events occur. What occurs is either the IQ-1000 II initiates a power-down condition or the main contactor drops out. As indicated in the figure, the factors which determine which of the conditions occur are:

- The loading of the IQ-1000 II's power supply at that time
- The type of contactor being used

In either case, if AC power remains off, eventually the IQ-1000 II initiates a "power-down condition". In this case the microprocessor has lost intelligence due to the low voltage condition and will perform a power-up reset when power is restored.

NOTE

The IQ-1000 II will display the message "THINKING" for approximately three seconds after the unit is powered up. The motor is not being protected during this time and will not be allowed to start if the unit is in Mode 2 operation (see Paragraph 8.20).

7.4 Control Signal Wiring — The IQ-1000 II communicates with the motor, contactor, and the associated machine or process through the following means:

- Discrete inputs from devices such as pushbuttons or relay contacts
- Outputs, in the form of relay contacts

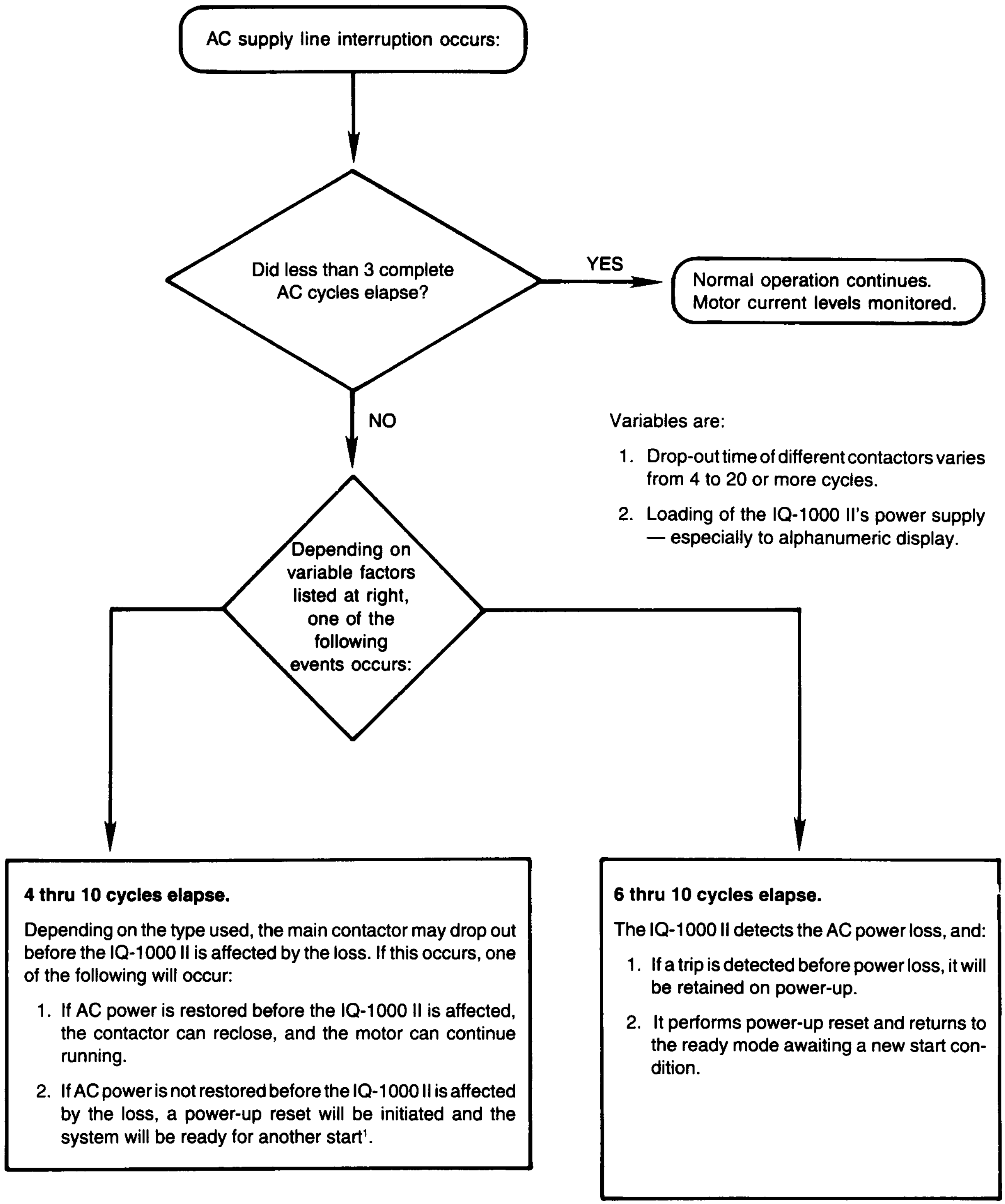
Each of these topics is discussed separately in the following subparagraphs.

Additionally, there are other sensing inputs from the optional ground fault transformer and current transformers. (These are not discussed here.)

The following two inputs are available and may optionally be used:

- REMOTE INPUT (terminal 8 on rear of unit). This input is used either to externally reset from a trip condition, to initiate a trip condition, or to detect a motor stop (see Paragraph 8.22).
- INC SEQUENCE (terminal 10 on rear of unit). This input affects the incomplete sequence report back function (program menu item 40) associated with the transition operation (see Paragraphs 7.2.1 and 8.16 for details).

7.4.1 Discrete Inputs — The discrete input terminals, if used, accept user-supplied 120 VAC from field devices such as switches, pushbuttons, relay contacts, etc. The IQ-1000 II's input contacts must remain closed for a minimum time of 17 cycles in order for the new state to be reliably sensed by the IQ-1000 II. This duration allows a distinction to be made between electrical noise and the actual 50/60 Hz signal. The characteristics of the circuits associated with these inputs are listed in Table 7.A.



[1]If AC power is restored, the contactor does not automatically reclose until start pushbutton is depressed.

Figure 7.7 — AC Interrupt Events Flow Chart

DANGER

When planning discrete input wiring, ensure that the leakage current to the input terminals does not exceed 10 mA. 50/60 Hz leakage currents can be excessive when discrete input signals are derived from certain control devices or input devices are separated from the IQ-1000 II by long wire runs. An example of this dangerous situation could involve the remotely located contacts of a programmable controller's output module. These could have a leakage greater than 10.0 mA. Excessive leakage currents can cause spurious signals at the IQ-1000 II's discrete input terminals. These may interfere with the start and run cycles' motor sequences. Erratic sequences may cause personal injury or equipment damage.

Table 7.A

DISCRETE INPUT CIRCUIT CHARACTERISTICS

Characteristic	Specification
Input voltage	120 VAC ONLY
Opto isolation	1500 volts
Input impedance	26K ohms
Input current drain (ON)	4.5 mA
Input current drain (OFF, max.)	10.0 mA

7.4.2 Output Contacts — The IQ-1000 II's output contacts correspond to the externally accessible terminals of the internal relays, as shown in Figure 7.8. These are all rated as:

- 240 VAC at 10 amperes (resistive)
- 30 VDC at 10 amperes (resistive)

The Trip, Transition, and Auxiliary Trip Relays are discussed throughout Section 8, but especially in Paragraphs 8.14 thru 8.20.2. Also, see Paragraph 3.2 for the Auxiliary Trip Relay.

7.5 Wiring Considerations — A suitable wiring plan that shows the interconnections between the IQ-1000 II and the associated machine or process must be developed by the user. This paragraph contains information needed by the application engineer who is developing a specific wiring plan. A typical example of a wiring plan is shown in Figure 7.9.

All wiring must be in conformance with the National Electrical Code as well as any other applicable state and/or local codes.

7.5.1 Wire Routing and Wire Types — When routing wires between the starter and the associated machine or process equipment, follow these guidelines:

Guideline 1 — Do not route the control or RTD conductors through the high-voltage compartment of the motor starter. If it is necessary to do so, consult Westinghouse Electrical Components Division for specific instructions.

Guideline 2 — Separate the lower voltage (120 VAC) from the higher voltage (440 VAC, or higher) conductors as much as possible. In general, maintain a minimum distance of 1.5 ft. (45 cm) between the two types.

Guideline 3 — Any low-voltage control wiring routed out of the motor starter cabinet should be at least #14 AWG stranded copper wire.

Guideline 4 — The wiring between the IQ-1000 II and the RTD Module should be at least #14 AWG stranded copper, 3-conductor shielded cable.

Guideline 5 — The wiring between the RTD Module and the RTDs in the motor must be #18 AWG, 3-conductor shielded cable.

7.5.2 RTD Wiring — If the optional RTD Module is used, each RTD must be wired as shown in Figure 7.10. Also, note the following requirements:

- Use 10-ohm copper, 100-ohm platinum, 100-ohm nickel, or 120-ohm nickel RTDs. The Universal RTD Module is DIP switch selectable to read any of these types of RTDs.
- Unused RTD inputs on the RTD Module should be wired together. For example, if MW5 and MW6 are unused, MW5 terminals 13, 14, and 15 should be wired to each other and MW6 terminals 17, 18 and 19 should be wired together.
- The interconnecting cable between the RTD Module and the RTD must have the cable's shield connected to the RTD Module ONLY. Cut the shield short at the RTD end and use shrink tubing or electrical tape to insulate it.
- When making connections between the RTD Module and an RTD that has only two leads, connect two of the interconnecting cable's leads to one of the RTD's leads (see Figure 7.10). Make this connection as close to the motor as possible. Tie the third interconnecting lead to the remaining RTD lead.
- When making connections between the RTD Module and a three lead RTD, connect the shield and drain wire to the RTD Module terminal as shown in Figure 7.10.

7.5.3 Grounding — The IQ-1000 II should be connected as follows to ensure proper operation:

- Connect the ground side of the control power transformer to terminal 7 of the IQ-1000 II.
- Connect a #14 AWG wire between terminal 5 and the main ground bus of the system. **Do NOT connect terminals 5 and 7 together**. The ground connecting terminal 5 to the system ground bus must be a non-current carrying ground.
- Connect one side of the CTs to the system ground. System noise may disrupt the IQ-1000 II if the CTs are tied to a current carrying ground.

The sizing and type of insulation for the AC supply line and the grounding electrode conductor must be in conformance with the National Electrical Code.

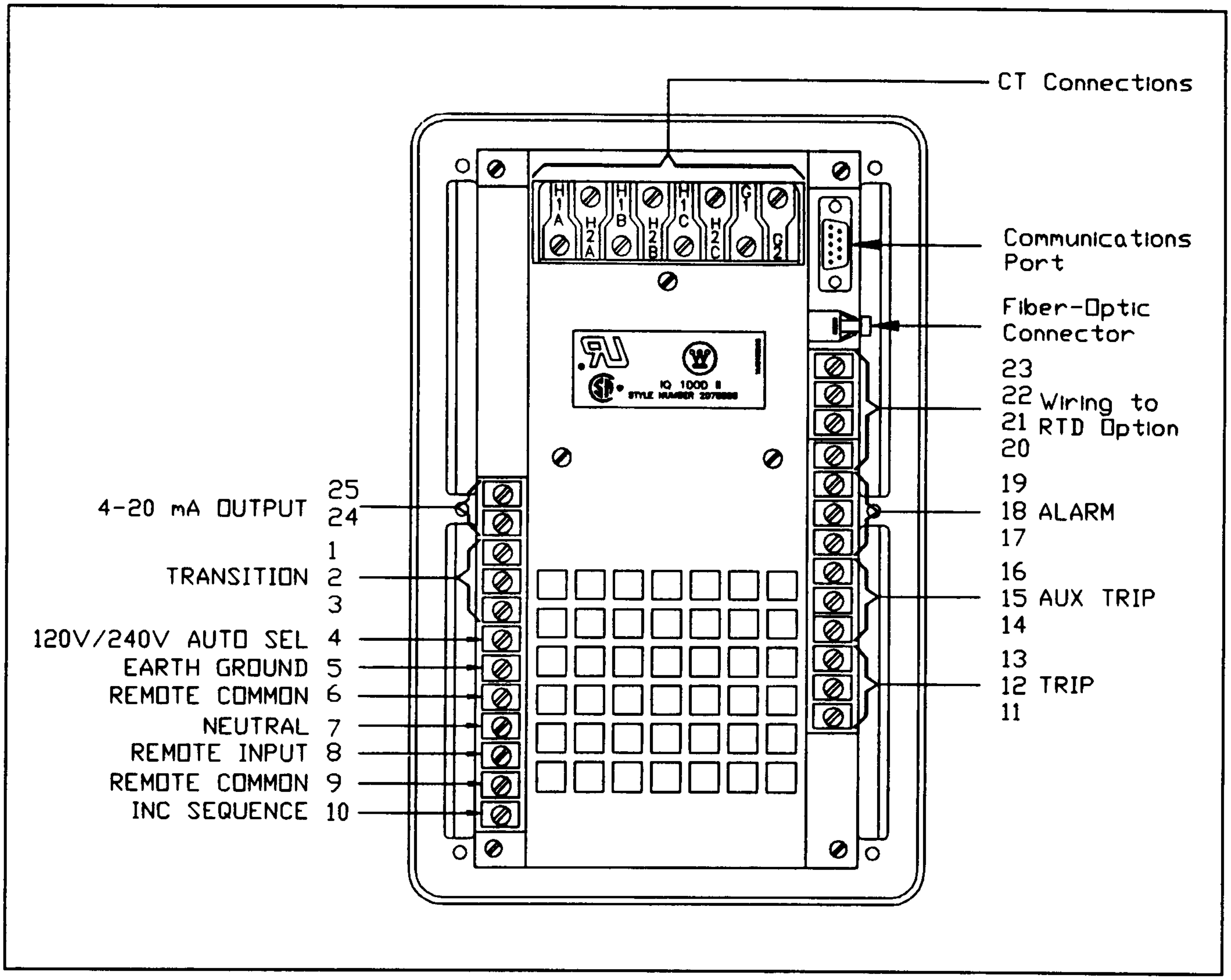


Figure 7.8 — IQ-1000 II Rear Panel Terminals

7.6 Environmental Considerations — Consideration must be given to the location of the IQ-1000 II enclosure in the plant. The unit operates within an ambient range between 0 to 70°C (32 to 158°F) with a humidity factor of 95% non-condensing.

The IQ-1000 II's circuit boards are conformal-coated to withstand environmental contaminants. However, special precautions may be required for extremely dirty or corrosive environments (consult Westinghouse Electrical Components Division).

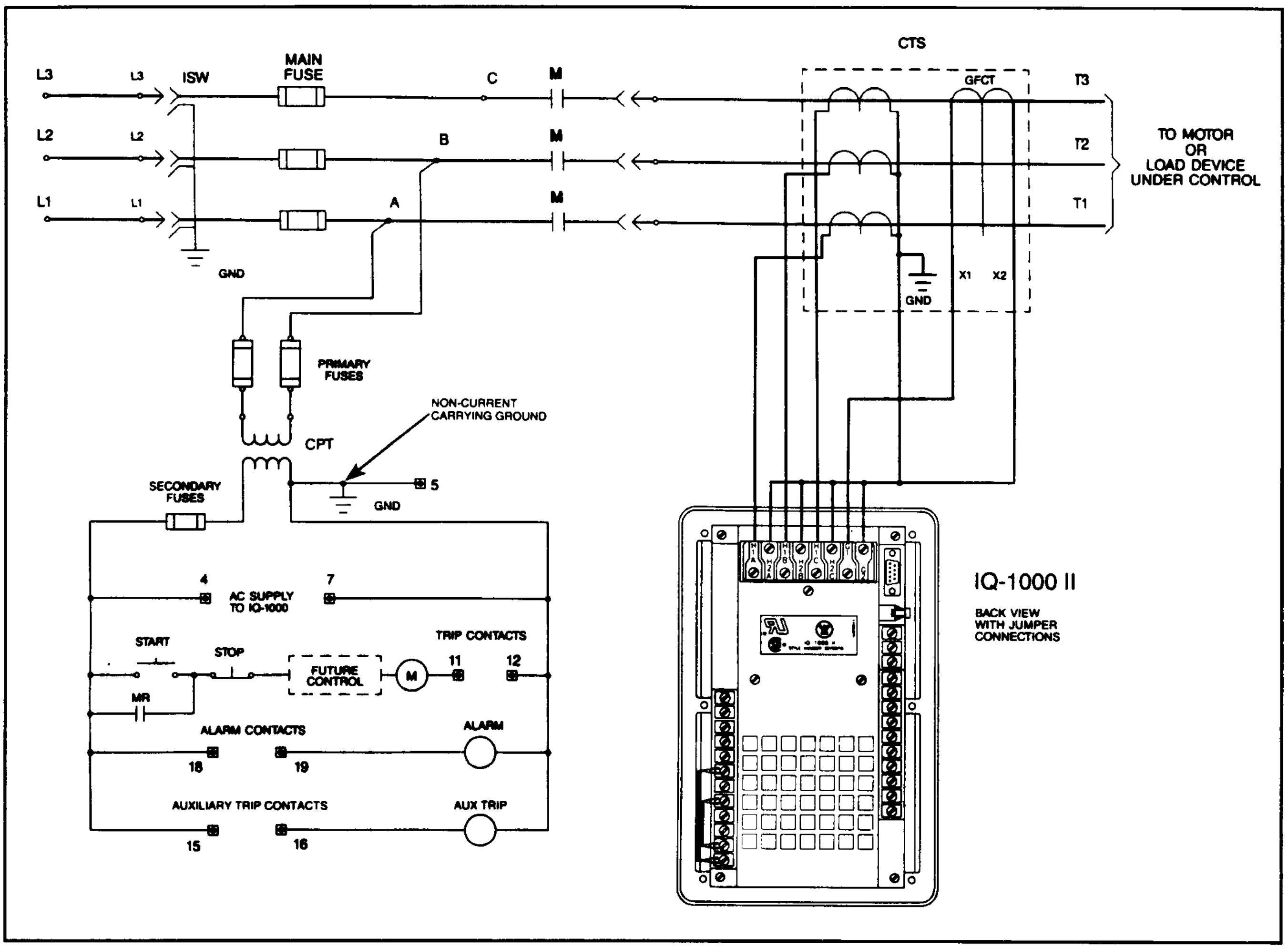
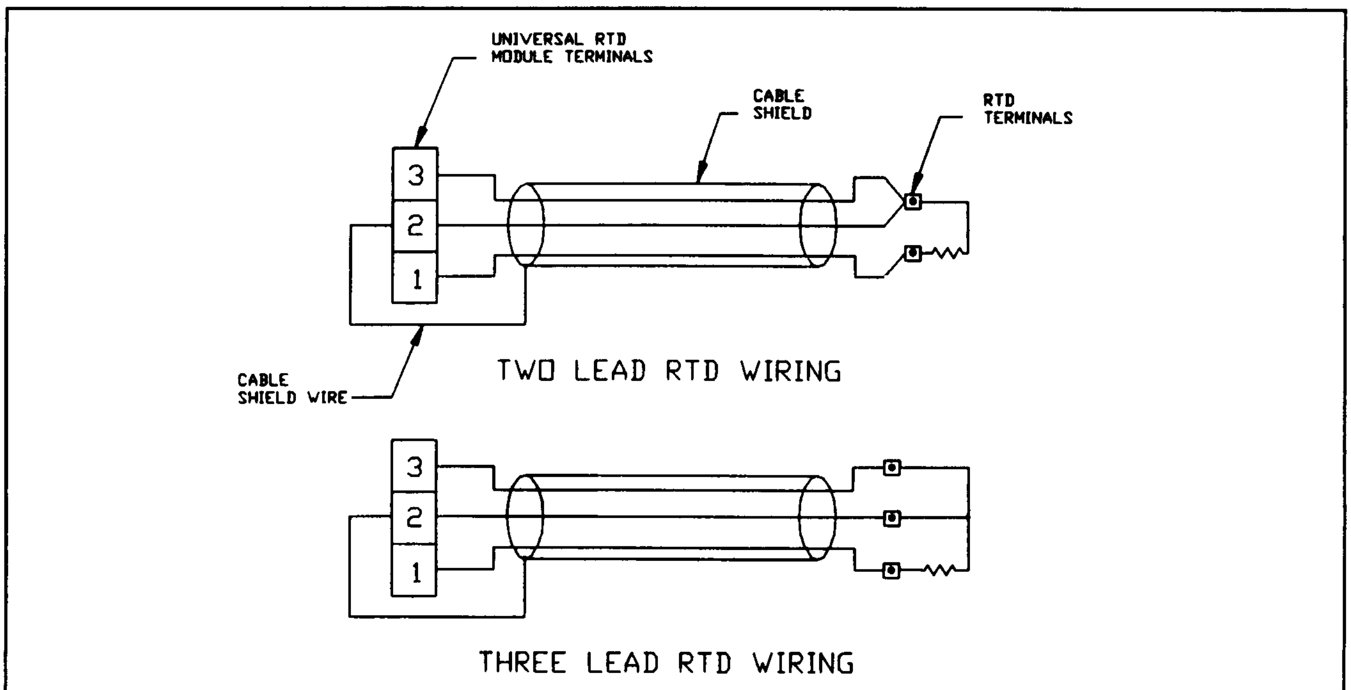


Figure 7.9 Partial Wiring Plan Example



7.10 — RTD Wiring Examples