

IQ-1000 II Motor Protection System



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Acknowledgment: Component pictures, wiring diagrams, and support information furnished through the courtesy of Cutler-Hammer, Industrial Controls Division.

Introduction

The IQ-1000 II is a multi-function motor protection relay. Its primary function is to provide sophisticated overload and over-temperature motor protection. By monitoring three phase current, in comparison to preprogrammed rated load amps and locked rotor amps, the device makes separate trip and/or alarm decisions.

Because of a proven algorithm cast into the microprocessor, positive and negative sequence current sampling and true RMS value calculations, maximum overcurrent protection is assured, with virtually no nuisance tripping.

In addition to providing the overcurrent and overtemperature protection mentioned above, the IQ-1000 II provides:

- Motor start and run transition signals based upon percent of rated load amps, or time, depending on which value occurs first.
- Feedback of starter transition completion.
- Safety trip if transition has not occurred.

- Number of “starts” allowed per time period scheduled.
- Phase loss and phase unbalance alarm and trip.
- Phase reversal protection and trip.
- Ground fault sensing and trip (if applicable) and programmed delays if required.
- Instantaneous overcurrent trip for both starting and running phases.
- Jam “start” and “run” programmable delays and trip protection.

“Jam” is a mechanical fault that results in a momentary increase in the amps consumed by the motor.

Other functions are available but may not be activated with McQuay centrifugal compressors.

Monitored and Displayed Values

Monitored Values

The IQ-1000 II allows the user to monitor the actual operating values of various metered functions. See Table 1 for a complete list.

Also displayed:

1. on Demand
 - a. Setpoint values
 - b. Monitored conditions recorded just prior to a trip condition
2. Automatically
 - a. Alarm conditions

- b. Trip conditions
- c. Internal diagnostic failure messages
- d. Normal operation reporting as follows:
 - Ready - Motor ready to start
 - Start - Motor engaged in starting
 - Run - Motor running

Programmed Values

Devices furnished for use with starters supplied for McQuay centrifugals will be preprogrammed in accordance with the values in Table 2. All setpoints are stored in “nonvolatile” memory. Battery backup is not required.

Table 1. Monitored Conditions

ITEM NO.	DISPLAY	“HELP” DESCRIPTION	RESOLUTION
0	READY X	Ready to start motor — Ready 1	
		For Single Phase Mode — Ready 3	
		For Three Phase Mode/Attempting — Start	
		To Start Motor/Motor Is Running — Run	
1	IA	Phase A Current in Amps	1 Amp
2	IB	Phase B Current in Amps	1 Amp
3	IC	Phase C current in Amps	1 Amps
4	IG	Ground Fault Current in Amps	1 Amp
5	%IA	Percent Full Load Current in Phase A	1%
6	%IB	Percent Full Load Current in Phase B	1%
7	%IC	Percent Full Load Current in Phase C	1%
8	OCNT	Operation Count	1 Count
9	RT	Run Time in Hours	1 Hour
10	RMST	Remaining Starts	1 Start
11	OST	Time Left on Oldest Start in Minutes	1 Minute
12	IMX	Highest Phase Current Since Last Reset	1 Amp
13	WTMX	Highest Winding Temperature Since Last Reset	1°C
14	I ² T	Number of I ² T Trips Since Last Reset	1 Trip
15	IOC	Number of IOC Trips Since Last Reset	1 Trip
16	UL	Number of UL Trips Since Last Reset	1 Trip
17	JAM	Number of Jam Trips Since Last Reset	1 Trip
18	GF	Number of GF Trips Since Last Reset	1 Trip
19	RTD	Number of RTD Trips Since Last Reset	1 Trip
20	ICM	Address on the IMPACC Network	1 (Hex)
21	%I ² T	Percent of I ² T Trip Level	1%

Table 2. IQ-1000 II Factory Setpoints

ITEM NO.	PROGRAM MENU DISPLAY	DISPLAY DESCRIPTION	SETPOINT RANGE SELECTIONS	FACTORY SETTING
0	SVER X	McQuay Software Version No.	N/A	McQuay 2.1
1	___Phase	Single Phase Test Mode or Three Phase Protection Mode	1 or 3	3 Phase
2	RTD in X	RTD Temperature in Degrees F or Degrees C	RTD in °C or °F	RTD in °C
3	WD T XXX	Winding Temperature Trip Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
4	MB T XXX	Motor Bearing Temperature Trip Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
5	LB T XXX	Load Bearing Temperature Trip Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
6	AX T XXX	Auxiliary Trip in Degrees C	0°-100°C/32-390°F (1° increment)	0
7	WD A XXX	Winding Temperature. Alarm Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
8	MB A XXX	Motor Bearing Temperature Alarm Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
9	LB A XXX	Load Bearing Temperature Alarm Setting in Degrees C	0°-100°C/32-390°F (1° increment)	0
10	AX A XXX	Auxiliary Alarm in Degrees C	0°-100°C/32-390°F (1° increment)	0
11	CG XX	Ground Fault Trip Setting in Amperes	1-12 Amps (1 amp increment)	Approx. 1% FLA (See #42)
12	GFSD XX	Ground Fault Trip Start Delay in Cycles	1-20 Cycles (1 cycle increment)	5
13	GFRD XX	Ground Fault Trip Run Delay in Cycles	1-10 Cycles (1 cycle increment)	2
14	IOC XX	Enable or Disable IOC Safety	Toggles Between IOC On and IOC Off	IOC On
15	IOC XXXX	Instantaneous Overcurrent Trip in % RLA	300-1600% (1% increment)	See Note 1
16	IOCSD XX	Instantaneous Overcurrent Start Delay in Cycles	1-20 Cycles (1 cycle increment)	1
17	LRC XXXX	Locked Rotor Current in % RLA	300-1200% (1% increment)	Set From Data Plate
18	LRT XX	Locked Rotor Stall Time in Seconds	1-60 Seconds (1 second increment)	5 Sec.
19	UTC XXX	Ultimate Trip Current in % RLA	85-125% (1% increment)	107%
20	I ² TA XXX	I ² T Alarm Level in % I ² T Trip	60-100% (1% increment)	75%
21	MAN RST/AUTO RST	Manual or Auto I ² T Reset	Toggles Between MAN RST & AUTO RST	MAN RST
22	JM A XXX	Jam Alarm Level in % RLA	100-1200% (1% increment)	115%
23	JM T XXXX	Jam Trip Setting in % RLA	100-1200% (1% increment)	150%
24	JAMS XX	Starting Jam Trip Delay in Seconds	0-60 Seconds (1 second increment)	TRNT+5 Sec. (See #38)
25	JAMR XX	Running Jam Trip Delay in Seconds	0-240 Seconds (1 second increment)	1 Sec.
26	UL A XX	Underload Alarm Level in % RLA	0-90% (1% increment)	30%
27	UL T XX	Underload Trip Setting in % RLA	0-90% (1% increment)	20%
28	ULSD XX	Underload Trip Delay Upon Motor Start in Seconds	0-100 Seconds (1 second increment)	1 Sec.
29	ULRD XX	Underload Trip Delay in Seconds	0-10 Seconds (1 second increment)	1 Sec.
30	PU A XX	Phase Current Unbalance Alarm Setting in % Unbal.	10-50% (1% increment)	10%
31	PURD XX	Phase Current Unbalance Alarm Delay in Seconds	0-240 Seconds (1 second increment)	60 Sec.
32	I ² T TRIP/2 SEC	2 Second Delay or I ² T Trip On Phase Unbalance	Toggles Between I ² T TRIP % 2 SEC	2 Sec.

Notes:

1. Divide Locked Rotor Current (Delta) by RLA rating and multiply the result by 200. Set the IOC value for the answer obtained or 1600%, whichever is less.
2. With Program 44 set for Mode 2, the bell relay operates simultaneously with the trip relay and in the same manner.

(Continued on next page)

Table 2 (cont'd). IQ-1000 II Factory Setpoints

ITEM NO.	PROGRAM MENU DISPLAY	DISPLAY DESCRIPTION	SETPOINT RANGE SELECTIONS	FACTORY SETTING
33	ST/T XX	Motor Starts Allowed Per Time Period	1-10 Starts/Time (increment of 1)	1
34	T/ST X	Motor Starts Timing Period in Hours	0-240 Minutes (1 minute increment)	0
35	OP COUNT	Reset For Operations Count	Toggles Between OP COUNT & OCNT	0
36	RUN TIME/RST RT	Reset For Run Time	Toggles Between RUN TIME & RST RT	0
37	TRNC XXX	Motor Start Transition Current Level in % RLA	50-150% (1% increment)	90% Star/Delta 150% LA and Solid-State
38	TRNT XXX	Motor Start Transition Time in Seconds	0-240 Seconds (1 second increment)	25
39	TRN TOUT/TRP TOUT	Transition or Trip On Time-out	Toggles Between TRN TOUT & TRP TOUT	TRN TOUT
40	INSQ XX	Incomplete Sequence Report Back Time in Seconds	0-60 Seconds (1 second increment)	2
41	ABKS XXX	Restart Time Delay in Seconds	0-600 Seconds (1 second increment)	0 MicroTech 25 non-MicroTech
42	FLA XX	Full Load Amps	10-3000 Amps (1 amp increment)	Set From Data Plate
43	FREQ 50/FREQ 60	50 or 60 Hertz Line Frequency	Toggles Between FREQ 50 & FREQ 60	Set From Data Plate
44	MODE 1/MODE 2	Trip Mode 1 - Trip Relay Energizes On Trip Condition Trip Mode 2 - Trip Relay Drops Out On Trip Condition	Toggles Between MODE 1 & MODE 2	Mode 2 SEE NOTE 2
45	NON REV/REV	Nonreversing/Reversing Controller	Toggles Between REV & NON REV	NON REV
46	REM TRIP/REM RST	Trip or Reset On Remote Input	Toggles Between REM TRIP, REM RST DIF TRIP & MTR STOP	REM TRIP
47	MAX XXX	4-20mA Maximum Output 100 or 125% RLA	Toggles Between MAX100, MAX125, MAX%I ² T & MAXWRTD	MAX 125
48	AUX XXX	Trip Start For Auxiliary Trip Relay	Toggles Between ALL, IOC, I ² T, GFLT, JAM, UL, MBT, LBT, WT, & REV	ALL
49	TRIP XXX	Reset For Number of Trips	Toggles Between TRIP CNT & TRIP RST	TRIP CNT
50	MAX XXX	Reset For Maximum Values	Toggles Between MX R-EBL, MX RESET & MX R-DBL	MX R-DBL
51	XXX PGM	Enables Unto To Be Programmed While Running	Toggles Between RUN PGM & STOP PGM	STOP PGM
52	X/5 XXXX	CT Ratio X Turns To 5	Available CT Turns: 5 Ratios are 10, 20, 25, 75, 100, 125, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 2000, 2500, 3000, 4000	Set From CT Data Plate Number of Primary Turns (X)

Notes:

1. Divide Locked Rotor Current (Delta) by RLA rating and multiply the result by 200. Set the IOC value for the answer obtained or 1600%, whichever is less.
2. With Program 44 set for Mode 2, the bell relay operates simultaneously with the trip relay and in the same manner.

Operator Panel

This section describes both the IQ-1000 II's Operator Panel and the procedures for setpoint entry, modification and examining monitored motor parameters.

General Description

All indicators displays and pushbuttons are located on the faceplate (see Figure 1). White colored lettering relates to the Protection mode and black colored lettering relates to the Program mode. A keyswitch, which switches the IQ-1000 II between Protection and Program modes, is located on the right side of the unit's chassis as it is viewed from the rear (see Figure 2).

The Key

Each unit is equipped with a keylock providing security against unauthorized modification of the setpoints. Keys for the devices are not shipped with each unit, but are furnished to McQuayService technicians for use and disposition following start-up of the unit. In this manner, the values programmed into the IQ-1000 II at the point of manufacture are protected.

Note: The key can be removed only when the switch is in the Protection mode.

Status Indicator LEDs

The IQ-1000 II has four status indicator LEDs: Protection, Program, Alarm and Trip.

The Protection LED is lit when the keyswitch is in the Protection position.

The Program LED is lit when the keyswitch is in the Program position. The Program LED blinks continuously when the keyswitch is in the Protection position and the Set Points/Step pushbuttons are pressed to review programmed setpoints (see Protection Mode). The blinking Program LED indicates that the program menu, not protection monitor data, is being displayed.

The Alarm LED is lit when an alarm setpoint value has been equalled or exceeded.

The Trip LED is lit when a trip condition has occurred. The Trip LED blinks continuously when the keyswitch is in the Protection position and the Set Point/Step pushbuttons are pressed to review pre-trip data. The blinking Trip LED indicates that pre-trip data is being displayed and that a trip condition is not present.

Program Mode

The Program mode permits the operator to enter and/or change individual menu values. When the switch is in the program mode, and setpoint 51 is set to STOP PGM (all units are shipped from the factory with setpoint 51 set to STOP PGM) the motor can not be started. Also the motor must be stopped before entering the program mode. Placing the switch to the Program position with the motor running will not initiate the Program mode.

When the switch is in the Program position and setpoint 51 is set to RUN PGM, the motor can be started and/or run while programming.

Caution: If setpoint 51 is set to RUN PGM and the motor is running while setpoints are being entered, all IQ-1000 II motor protection features are disabled and the motor is unprotected until the switch is returned to the Protection position.

Protection Mode

When the keyswitch is in the Protection position, the controlled motor can be started or stopped and is allowed to run normally, as defined by the setpoint values programmed. In the Protection mode, the IQ-1000 II monitors motor parameters and provides protective functions for the controlled

Figure 1. IQ-1000 II Faceplate

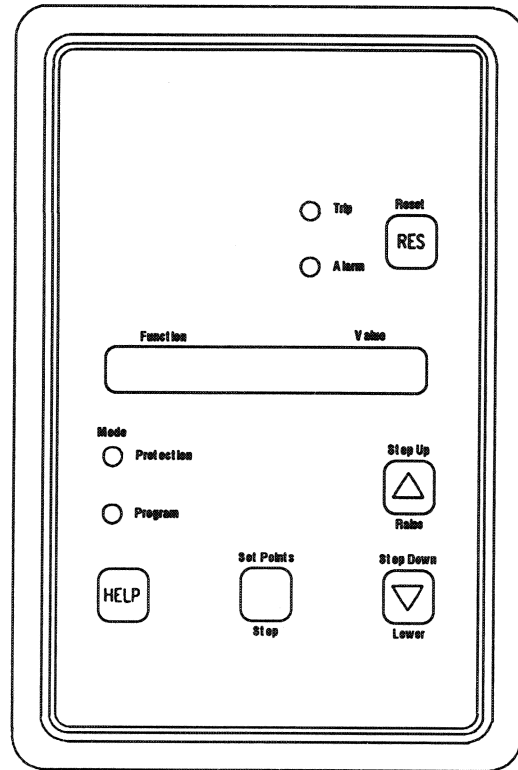
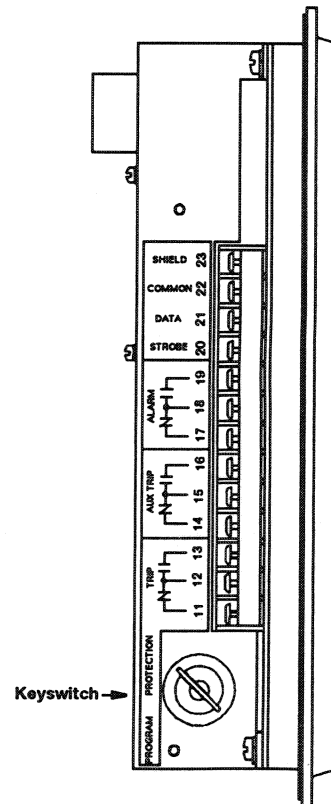


Figure 2. Keyswitch



motor.

Individual setpoints may be examined in the protection mode but they cannot be modified.

Installation

IQ-1000 II motor protectors are shipped installed and factory pre-wired. Numbered and identified terminals are accessible on the back side of the device. They should be properly connected, with or without terminal jumpers as required by the type starter furnished.

In the event the IQ-1000 II is being furnished to replace an existing IQ-1000, the following guidelines should be followed.

1. **Do not jumper** terminals 4 to 6 and 5 to 7.
2. Connect the high line of the control power to terminal 4 and the grounded side of the control power transformer to terminal 7.

3. Connect a separate earth ground from terminal 5 to the system ground bus. This connection must be a dedicated connection. **Do not connect terminal 5 to 7.**
4. In order to disable the Incomplete Sequence function, jumper terminal 4 to 10 and terminal 6 to 9. These jumpers are installed at the factory.
5. **Terminal 6 is only to be used for the jumper connection to terminal 9.**
6. **Terminal 5 is only to be used for a direct connection to the system ground bus. Do not use terminal 5 as a grounding point for any other device.**

Pre-start Checks (Factory Installed Unit)

The following step-by-step procedure is recommended **prior to the routine application of power to a new IQ-1000 II installation.**

⚠ CAUTION

Only qualified personnel familiar with the IQ-1000 II, the motor starter, and its associated mechanical and electrical equipment should perform the start-up procedures listed here. Failure to observe this caution 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 apply high potential tests on this device, or on wiring or equipment connected to this device. Failure to observe this caution will result in equipment damage.

1. Verify that the isolation switch controlling the application of power to the IQ-1000 II is in the "off" position.
2. Verify that there is no other source of power to the control circuit of the IQ-1000 II, and there is therefore no possibility of feedback from the secondary to the primary side of the device's control power transformer.
3. Check to see if the alarm or bell relay's terminals are supplied by control power from another source. If they are, disconnect that source of power.
4. Verify that wiring connections to the various IQ-1000 II terminals comply with the wiring diagram furnished with the starter, and that terminal connections are secure.
5. Disconnect the AC control power line connected to terminal 4 of the IQ-1000 II.
6. Connect an AC voltmeter between the wire just disconnected from terminal 4, and terminal 7.
7. Open or otherwise disengage the MCR control circuit so that when power is re-applied the starters will not become energized.
8. Insert the key in the IQ-1000 II keyswitch and turn to the "Program" position.

Note: Placing the keyswitch in the program position prevents the connected motor from being started.

9. Turn the AC power on.

10. Read the voltage applied to the wire disconnected from terminal 4 (see step 6 above).

Note: The voltage should be 120 VAC or 240 VAC. If it is not approximately 120 volts (i.e., 110 to 125 VAC) or 240 volts (i.e., 230 to 245), check the secondary of the transformer.

11. Disconnect the AC power.
12. If the reading observed in step 10 above was correct, disconnect the voltmeter and reconnect the wire to terminal 4.

If the reading was incorrect for the application, reexamine the source of power before proceeding. Determine the source of the discrepancy and correct it.

13. With the keyswitch still in the "Program" position, and all wiring to the IQ-1000 II complete, re-apply the AC power to the circuit.
14. Obtain a copy of the setpoint record sheet.
15. Follow the instructions in the "Setpoint - Entry, Modification, and Examination" section to verify that setpoint values match those on the setpoint record sheet.
16. Examine the IQ-1000 II current transformers for a nameplate rating. These transformers must produce a secondary current at full load of 2.5 to 5.0 amps. They are located in line circuits (not in the phase wiring). Using the transformer rating and the unit's rated load amps (RLA), calculate the secondary current as follows:

$$\text{Secondary Amps} = \text{RLA} \times \frac{\text{CT Secondary Ratio}}{\text{CT Primary Ratio}}$$

CT ratios are normally "some" hundred to 5; i.e., 300 to 5,400 to 5,600 to 5, etc. Following assurance that the transformer ratio will produce the secondary amps required, check the value entered in Program No. 52. This value should equal the CT Primary Ratio.

17. Interrupt the AC voltage if the connected motor is not yet ready to run.

⚠ CAUTION

When the keyswitch is turned to the "Protection" position, the motor can be started if all other switches and thermostats in a circuit are closed. Take care to be sure that the motor cannot be started, if it should not at this time.

18. Place the keyswitch in the "Protection" position.

Setpoint - Entry, Modification, and Examination

Program Mode (Black Lettering)

Pressing the **Step** pushbutton sequences through the setpoints and settings in the order in which they are listed in the program menu. To cycle through the program menu in reverse, press and hold the **Step** pushbutton while repeatedly pressing the **Lower** (down arrow) pushbutton.

Pressing the **Raise** and **Lower** pushbuttons respectively increment and decrement the selected setpoint value.

Pressing the **Help** pushbutton provides a scrolling description of the displayed message, including units of measure, for any of the IQ-1000 II's messages. The Help message may be terminated by pressing the **Reset** pushbutton while the help message is displayed.

Pressing the **Reset** pushbutton will display the first item in the program menu.

Protection Mode (White Lettering)

Pressing the **Set Points** pushbutton causes the display window to display the software version installed in the IQ-1000 II. Pressing the up or down arrow key at this time causes the setpoints to be displayed sequentially.

Pressing the **Set Points** pushbutton again causes the display window to display PRE-TRIP. Pressing the up and

down arrows now will display the monitored motor parameters that were present the instant before the last trip condition occurred. The Protection LED remains lit and the Trip LED blinks as a reminder that the information being displayed pertains to a pre-trip state.

Pressing the **Set Points** pushbutton again will return the display to the system READY/RUN message.

Pressing the **Step Up** and **Step Down** pushbuttons when the READY/RUN message is displayed, will cause the display to step through the run-monitor data. This data contains information such as phase current, operations count, trip counts, etc. (see Table 1 for a complete listing of run-monitor data).

Pressing the Step up and Step Down pushbuttons when the software version message is displayed, will step through the setpoint values programmed in the IQ-1000 II.

Pressing the **Help** pushbutton has the same action as in the Program mode.

Pressing the **Reset** pushbutton will clear a trip condition if the cause of the trip condition has been corrected. If the Reset button is pressed and there is no trip condition present, the display window will display the first item of the run-monitor table (Table 1).

Dry Running The Starter

Standard procedure on a new installation requires that the starter be energized to assure proper function of relays, timers, interlocks and contact closures. This operation should be completed before the motor is connected. Some modifications of the IQ-1000 II may be required as follows.

Star(Wye) Delta Type Starters (Also Auto-Transformer and Primary Reactor)

Star-Delta, auto-transformer and primary reactor type starters transition from the starting to the running phase. As part of the protection provided, the IQ-1000 II initiates then proves this transition. In order to test the starter without the motor connected, the normal sequence of the IQ-1000 II must be modified as follows:

Transition related functions are Program Nos. 37, 38, 39, and 40.

With a motor connected to the starter, upon the application of voltage to the motor terminals, a current greatly in excess of normal running current flows. When 30% of full load is detected in any phase the IQ-1000 II declares a start sequence. As the rotating speed of the motor increases, the current flow decreases. When the flow of current falls below the percent of rated load current setting established for the IQ-1000 II's Program No. 37, the device energizes its transition relay and transition takes place. Under normal (connected motor) conditions, proof that the transition sequence was completed would be evidenced by the application of 120 volt power to IQ-1000 II terminal 10 through the starter interlocks.

When dry running the starter (disconnected motor) 30% of full load amps won't be detected by the IQ-1000 II. Power will not be applied to terminal 10 and an incomplete sequence trip will occur. For dry running purposes, this problem can be overcome by adjusting the FLA (program no. 42 to 10 amps. 30% of 10 amps or 3 amps can then be provided in order for the IQ-1000 II to declare a start and allow transition. The current demand for the compressor oil pump will generally be sufficient. Being the current demand for the oil pump will be energized before dry running the starter and the motor amps won't decay, the IQ-1000 II will initiate transition based on time instead of percent of rated load

amps.

If the oil pump is not able to be run and in absence of any current that represents 30% of full load amps, the transition relay will not pull in. If it is necessary to have transition to complete a circuit, a jumper can be installed between terminals 2 and 3 to simulate a normal transition.

Note: In dry running the starter through its operating sequence, if the 120 volt power application will not be complete to terminals 9 and 10, the IQ-1000 II will cause a trip action in 2 seconds and the LED will read (INSQ 02) for "Incomplete Sequence."

To complete the 120 volt circuit under these conditions, on starters and IQ-1000 II devices furnished by McQuay for 120 volt control power:

1. Disconnect the AC power to the circuit supplying the IQ-1000 II power.
2. Connect jumpers from terminal 9 to terminal 6 and from terminal 10 to terminal 4.
3. Reconnect the AC power.

If the IQ-1000 II has tripped off as indicated above, it will remain tripped until the "Reset" button is pushed. Pushing the reset button with the keyswitch in the "Run" position will clear the trip if the fault condition has been corrected.

Solid-State & Across-The-Line Starters

Starters furnished without the transition feature such as across-the-line and solid-state will have the Program Menu No. 37 factory set at 150% and Function 40 disabled by means of jumpers as described above.

Note: IN DRY RUNNING a Star-Delta starter, transition from the initial application of power in "Star" to "Delta" may take place as quickly as within eight (8) electrical cycles. This almost instantaneous action must not be interpreted to mean that the settings are incorrect or that the IQ-1000 II is defective. Without a motor connected to the starter there is no inrush current. The microprocessor "sees" a current below the percentage of rated load amps which is the setting for Program No. 37 and transition is initiated.

When the motor is connected, normal transition for Star to Delta will take place.

CAUTION

- If jumpers were added between terminals 2 and 3, 6 and 9, and between terminals 4 and 10 to permit dry running a Star-Delta starter:
1. Interrupt the AC voltage source to the IQ-1000 II.
 2. Remove the jumpers.
 3. Reconnect the AC voltage circuit.

Note: All Types of Starters

To permit the starter to be "dry run" without a motor connected, Program No. 29, "Underload run delay in seconds," must be set at 1 second, disabling this function. It has been factory set at 1 second and must be reset to 3 seconds after completion of the "dry run" test. Reset Program No. 22, "ULRD," to 3 seconds as described in the section headed "Setpoint - Entry, Modification and Examination."

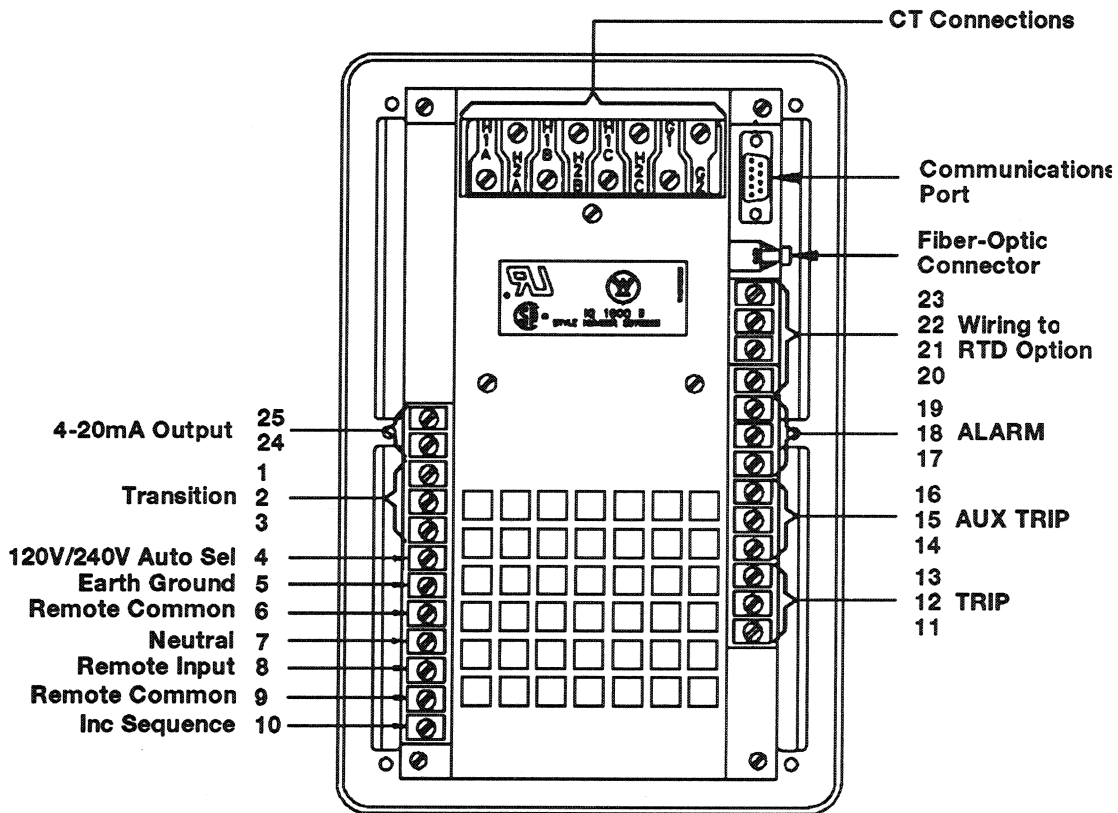
Normal Transition

When voltage is first applied to the motor terminals, inrush current greatly in excess of rated load amps flows. As the motor begins to rotate, the current flow decreases. Within seconds, the motor speed may approach its normal operating RPM and as it does, the current being drawn by the motor will fall below the rated load amps (RLA). When the IQ-1000 II determines that the amperage drawn is 90% or less of RLA (Program No. 37), its transition relay is energized. Transition from Star to Delta is initiated.

In the event starting amps do not decay to 90% of RLA within 25 seconds (Program No. 38), then the IQ-1000 II will initiate a transition based upon time instead of percent of rated load amps.

This action may be required if liquid refrigerant is returning to the compressor, delaying the normal increase in RPM and decrease in current. Program No. 39 should be set to initiate transition following passage of the 25-second interval established for Program No. 38.

Figure 3. IQ-1000 II Wiring Terminals



Typical Wiring Diagrams

Figure 4. Full Voltage

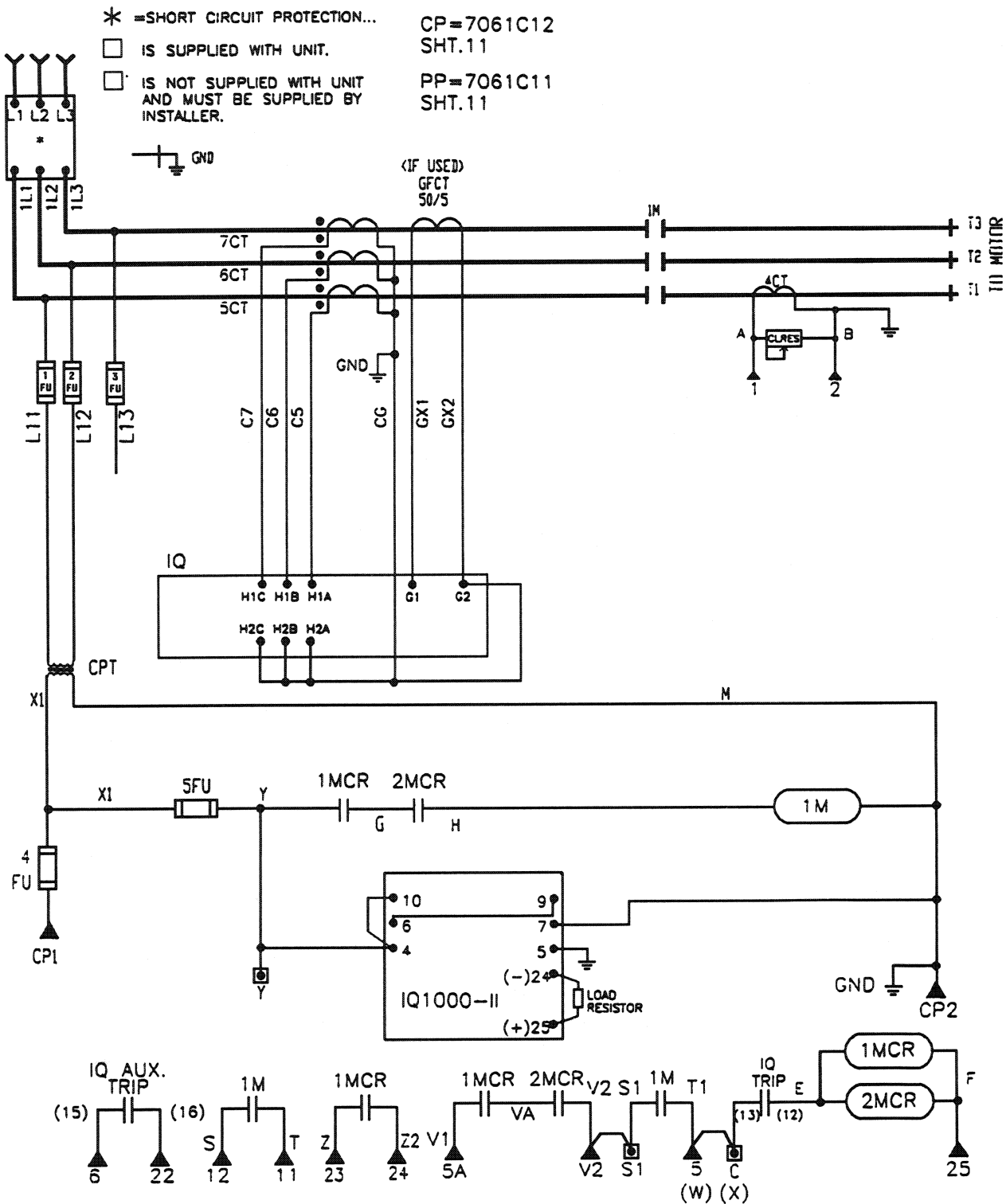
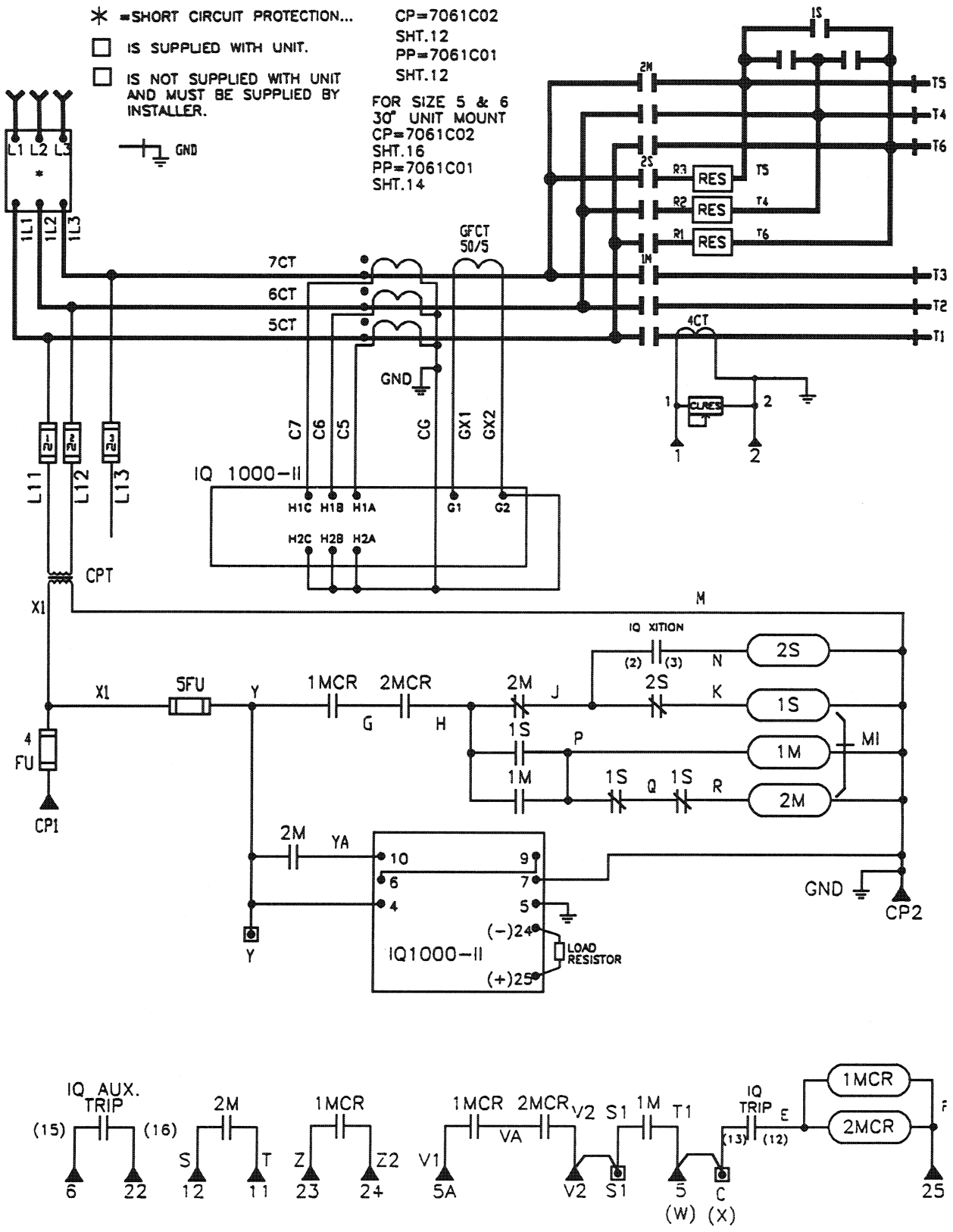


Figure 5. Star-Delta Closed Transition



Trouble Diagnostics & Analysis

Table 3.

DISPLAY	COMPLETE HELP MESSAGE	PROBABLE CAUSE	SOLUTION
IOC GND FLT JAM UNDER L	INSTANTANEOUS OVERCURRENT TRIP GROUND FAULT TRIP LOAD JAM TRIP UNDERLOAD RUN TRIP	In each case, the actual electrical value monitored is greater than the trip setpoint value for the function displayed.	Monitor the associated electrical characteristics (as listed in Table 1) to further isolate the problem.
MB TEMP* LB TEMP* WD TEMP*	MOTOR BEARING OVER TEMPERATURE TRIP LOAD BEARING OVER TEMPERATURE TRIP STATOR WINDING OVER TEMPERATURE TRIP		(These protective functions are provided separately in the control center.)
LRC/I2T	LOCKED ROTOR/THERMAL OVERLOAD TRIP	The rotor winding temperature storage, as directed by the IQ-1000 II's motor temperature algorithm, has exceeded the maximum allowable value of the I2T protection curve (motor overload curve).	Monitor the electrical characteristics associated with the motor current to further isolate a problem to areas such as the AC line or motor overload.
INC SEQ	INCOMPLETE SEQUENCE TRIP	The INC SEQUENCE input (terminal 10) was not energized within the incomplete sequence time after a transition has taken place.	Monitor terminal 10 after a transition to the run mode. Check circuits connected to terminal 10, such as incomplete sequence, field loss, pull-out protection, etc.
REMOTE	REMOTE TRIP	The REMOTE INPUT (terminal 8), used to initiate the remote trip, was energized.	Check wiring to terminal 8 to determine external cause of trip.
DIF TRIP	DIFFERENTIAL TRIP	The REMOTE INPUT (terminal 8), used to initiate the differential trip, was energized.	Check status of external differential relay.
PH UNBAL	PHASE UNBALANCE TRIP	Single phasing of motor.	Monitor the incoming AC line.
PH REVRS	PHASE REVERSAL TRIP	During initial start-up a phase reversal condition exists.	Rotate two of the incoming power leads L1, L2, or L3. Check for proper motor rotation. Alternately, change the IQ-1000 II current transformer wiring by rotating the current transformer wiring terminal H1B with H1C. Clearly mark the new wiring and update the drawings for future reference.
T BYPASS	TRIP BYPASS (JUMPER BYPASS OF IW-1000 II TRIP RELAY)	A trip condition is active, yet the IQ-1000 II still monitors motor current. This indicates trip relay's contacts have been "bypassed."	Examine wiring of trip relay's contacts and remove bypass condition.
INCOM	INCOM REMOTE TRIP	The INCOM communications option has initiated a trip condition.	Determine and correct cause of remote trip external to the IQ-1000 II.
STEX	MAX # STARTS PER TIME REACHED, WHILE RUNNING ALARM ONLY, IF STOPPED BECOMES TRIP	Too many starts were used in the allowed period of time.	Wait for the starts to be returned or clear starts by entering Program mode.
TRANSIT (1)	LOW TO HIGH VOLTAGE	IQ-1000 II did not transition on current before the transition time was complete.	Reset trip, check reason for slow start and restart motor.

Notes:

*These protective functions are not used on McQuay units.

(1) This trip is initiated only if program menu item 39 is selected for the trip on time out function (TRP TOUT) and the motor current remained too high during the motor's start cycle.

Troubleshooting: Operator Panel Malfunctioning

Table 4.

SYMPTOM	PROBABLE CAUSE	SOLUTION
All LEDs and display windows are off or unintelligible.	Incoming AC deficient.	Verify that 120 or 240 VAC ($\pm 15\%$) exists between terminals 4 and 7. (Refer to the electrical drawings to further isolate a deficient AC line.
	IQ-1000 II malfunctioning.	Verify that all connections to the terminal blocks are secure. Turn keyswitch to the Program position for 5 seconds, then return to the Protection position. If all connections are secure and the Operator Panel is still inoperative, then replace the IQ-1000 II.
OPTO ERR Message	Optocoupler failure trip.	Check frequency setting.
Metered readings too low.	Incorrect CTs: secondary	Match CTs, CT ratio to deliver 2-5.5 amps secondary.

Internal Diagnostic Failure Messages

Table 5.

DISPLAY	COMPLETE HELP MESSAGE
A/D ERR	A/D CONVERTER ERROR TRIP
RAM ERR	RAM ERROR TRIP
ROM ERR	ROM ERROR TRIP
OPTO ERR	OPTO COUPLER FAILURE TRIP (2)
X-CTR	THE RATIO OF FLA TO CT RATIO EXCEEDED 5. PLEASE REDUCE THE FLA SETTING OR INCREASE CT RATIO (1)
ZRAM ERR	NONVOLATILE MEMORY ELEMENT SHOULD BE REPLACED

Notes:

- (1) The current transformer ratio (item 39) and/or full load ampere (item 32) setpoint values are incorrectly selected. Verify that the setpoints for these menu items on the application's Setpoint Record Sheet are entered correctly.
- (2) See "Troubleshooting" chart.

Alarm Conditions

Table 6.

DISPLAY	COMPLETE HELP MESSAGE	PROBABLE CAUSE	SOLUTION
I2TA	I SQUARED T ALARM LEVEL	The monitored rotor temperature exceeded the alarm level setpoint (60 to 100% of maximum temperature).	Monitor electrical characteristics to further isolate the malfunction to an area such as the incoming AC line or motor/load.
STEX*	ALLOWED STARTS EXCEEDED, WAIT IN MINUTES	All of the allowed starts have been used.	Wait the number of minutes shown on display or reset by entering Program mode.
WD AA*	WINDING TEMP ALARM	In each case the actual electrical value monitored is equal to or greater than the alarm setpoint value for the function displayed.	With each of the 6 different displays (at left), perform a monitoring function to further isolate the malfunction. Note: If the actual temperature of one or more of the RTDs does not correspond to the reading in °C, suspect the RTDs, RTD wiring, or the RTD module.
MB AA*	MOTOR BEARING ALARM		
LB AA*	LOAD BEARING ALARM		
PU AA*	PHASE UNBALANCE ALARM		
JAMA AA	JAM ALARM		
ULA AA	UNDERLOAD ALARM		

*Note: These alarm functions are not used on McQuay units.

Table 7. IQ-1000 Factory Setpoints

Note: This table is for IQ-1000s built after April 1989. IQ-1000s built prior to this time did not contain program item numbers 10, 29, and 30. Settings for the IQ-1000 II are found on pages 4 and 5.

ITEM NO.	PROGRAM MENU DISPLAY	DISPLAY DESCRIPTION	SETPOINT RANGE SELECTIONS	FACTORY SETTING
0	SVER X	McQuay Software Version No.	—	N/A
1	WD T XXX	Winding Temp. Trip Setting in Degrees C	0°-199°C (1° increment)	Blank
2	MB T XXX	Motor Bearing Temp. Trip Setting in Degrees C	0°-199°C (1° increment)	Blank
3	LB T XXX	Load Bearing Temp. Trip Setting in Degrees C	0°-199°C (1° increment)	Blank
4	AX T XXX	Auxiliary Trip in Degrees C	0°-199°C (1° increment)	Blank
5	WD A XXX	Winding Temp. Alarm Setting in Degrees C	0°-199°C (1° increment)	Blank
6	MB A XXX	Motor Bearing Temp. Alarm Setting in Degrees C	0°-199°C (1° increment)	Blank
7	CG XX	Ground Fault Trip Setting in Amperes	4-12 Amps (1 amp increment)	Approx. 1% FLA
8	GFSD XX	Ground Fault Trip Start Delay in Cycles	1-20 Cycles (1 cycle increment)	5
9	GFRD XX	Ground Fault Trip Run Delay in Cycles	1-10 Cycles (1 cycle increment)	2
10	IOC XX	Enable or Disable IOC Safety	Toggles Between ON and OFF	ON
11	IOC XXXX	Instantaneous Overcurrent in % RLA	200-500% (1% increment)	See Note 2
12	IOCSD XX	Instantaneous Overcurrent Start Delay in Cycles	1-20 Cycles (1 cycle increment)	2
13	LRC XXXX	Locked Rotor Current in % RLA	300-1200% (1% increment)	Set From Data Plate
14	LRT XX	Locked Rotor Stall Time in Seconds	1-60 Seconds (1 second increment)	5
15	UTC XXX	Ultimate Trip Current in % RLA	85-125% (1% increment)	107
16	I2TA XXX	I2T Alarm Level in % I2T Trip	60-100% (1% increment)	75
17	MAN RST/AUTO RST	Manual or Auto I2T Reset	Toggles Between MAN RST & AUTO RST	MAN RST
18	JAM XXXX	Jam Alarm Level in % RLA	100-1200% (1% increment)	150
19	JAMS XX	Jam Start Delay in Seconds	0-60 Seconds (1 second increment)	TRNT+5 Sec. (See #32)
20	JAMR XXX	Jam Run Delay in Seconds	0-240 Seconds (1 second increment)	1 Sec.
21	UL XX	Underload Trip Level in % RLA	0-90% (1% increment)	20%
22	ULSD XX	Underload Start Delay in Seconds	0-100 Seconds (1 second increment)	1 Sec.
23	ULRD XX	Underload Run Delay in Seconds	1-10 Seconds (1 second increment)	Factory Set: 1 Sec. Field Set: 3 Sec.
24	PU A XX	Phase Unbalance Alarm Level	10-50% (1% increment)	10%
25	PURD XX	Phase Unbalance Alarm Delay in Seconds	0-240 Seconds (1 second increment)	60 Sec.
26	I2T TRIP/2 SEC	2 Second Delay or I2T Trip On Phase Unbalance	Toggles Between I2T TRIP & 2 SEC	2 Sec.
27	ST/T XX	Starts Per Time Allowed	1-10 (increment of 1)	1
28	T/ST X	Time Allowed For Starts Count in Hours	0-4 Hours (1 hour increment)	0
29	OP COUNT	Operations Counter Reset	Toggles Between RST & OCNT	OCNT
30	RUN TIME	Run Time Reset	Toggles Between RST & RT	RT

Notes:

1. With Program 38 set for Mode 2, the bell relay operates simultaneously with the trip relay and in the same manner.
2. Divide Locked Rotor Current (Delta) by RLA rating and multiply the result by 200. Set the IOC value for the answer obtained or 1500%, whichever is less.

(Continued on next page)

Table 7 (cont'd). IQ-1000 Factory Setpoints

Note: This table is for IQ-1000s built after April 1989. IQ-1000s built prior to this time did not contain program item numbers 10, 29, and 30. Settings for the IQ-1000 II are found on pages 4 and 5.


ITEM NO.	PROGRAM MENU DISPLAY	DISPLAY DESCRIPTION	SETPOINT RANGE SELECTIONS	FACTORY SETTING
31	TRNC XXX	Motor Start Transition Current Level in % RLA	50-150% (1* increment)	Set at 90% for Star-Delta. Set at 150% for Across-The-Line and Solid-State Starters.
32	TRNT XXX	Motor Start Transition Time in Seconds	0-240 Seconds (1 second increment)	25 Sec.
33	TRN TOUT/TRP TOUT	Transition On Time Out/Trip On Time Out	Toggles Between TRN TOUT & TRP TOUT	TRN TOUT
34	INSQ XX	Incomplete Sequence Report Back Time	1-60 Seconds (1 second increment)	2 Sec.
35	ABKS XXX	Coast Down Delay Time in Seconds	0-600 Seconds (1 second increment)	MicroTech: 0 non-MicroTech: 25
36	RLA XXX	Full Load Amps	10-3000 Amps (1 amp increment)	Set From Data Plate
37	FREQ XX	50 or 60 Hertz Line Frequency	Toggles Between 50 Hz & 60 Hz	Set From Data Plate
38	MODE 1 MODE 2	Trip Relay Energizes On Trip Condition Trip Relay Energizes On Power Up & De-energizes On Trip (See Note 1)	Toggles Between MODE 1 & MODE 2	MODE 2
39	NON REV/REV	Reversing or Nonreversing Starter	Toggles Between REV & NON REV	NON REV
40	REM TRIP/REM RST	Trip or Reset on Remote Input	Toggles Between REM TRIP & REM RST	N/A
41	CTR XXX	Current Transformer Turns Ratio	Available CT turns: 1 ratios are 2, 4, 5, 8, 10, 100, 120, 150, 200, 240, 300, 400, 500, 600, 800	Set From CT Data Plate

Notes:

1. With Program 38 set for Mode 2, the bell relay operates simultaneously with the trip relay and in the same manner.
2. Divide Locked Rotor Current (Delta) by RLA rating and multiply the result by 200. Set the IOC value for the answer obtained or 1500%, whichever is less.



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