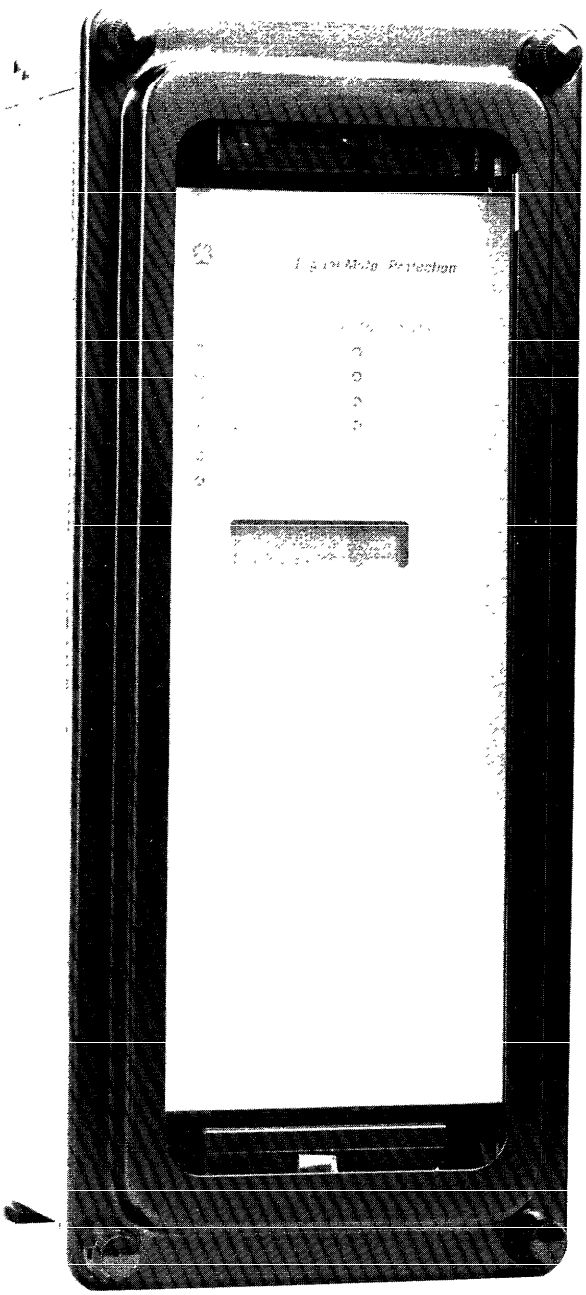
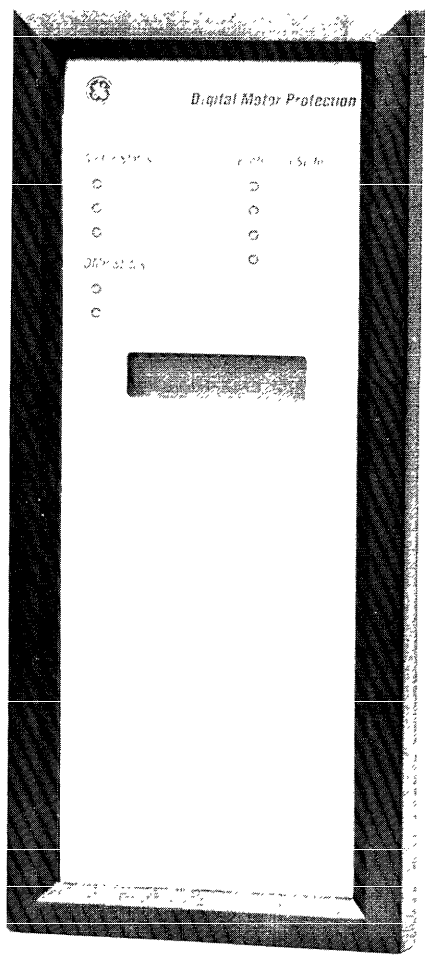
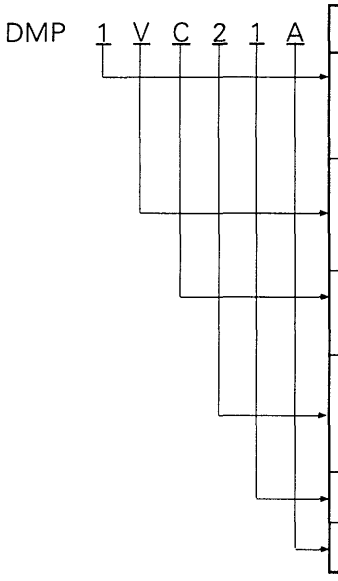
# DMP1 Relay

## User's Manual





Since this relay is available in a variety of configurations, take a moment to compare the catalog number of your purchased relay with the catalog number key below.




| Code | Description |
|---|---|
| 1 | Motor protection and control with voltage inputs |
| 2 | Motor protection with voltage inputs |
| 3 | Basic motor protection |
| D | Drawout construction (M2 case) |
| V | Fixed case, vertical orientation |
| H | Fixed case, horizontal orientation |
| C | 10 ohm copper RTD |
| P | 100 ohm platinum, 120 ohm nickel RTD |
| 1 | 115/230 Vac power supply |
| 2 | 110–250 Vdc power supply |
| 3 | 24–48 Vdc power supply |
| 1 | RS–485 communication port |
| | Revision level |

*DMP Motor Protection Relay System catalog number system.*

Example – a relay with catalog number DMP1VC21A has the following features:

- Motor protection and control with voltage inputs (1)
- Fixed case, vertical orientation (V)
- 10 ohm copper RTD (C)
- 110–250 Vdc power supply (2)
- RS 485 communication port (1)
- Revision level A

# GEK–100686

## *WARNINGS, CAUTIONS, AND NOTES AS USED IN THIS PUBLICATION*

### *WARNINGS*

Warning notices are used in this publication to emphasize that hazardous voltages, currents, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

Warning notices are also used for situations in which inattention or lack of equipment knowledge could cause either personal injury or damage to equipment.

### *CAUTIONS*

Caution notices are used for situations in which equipment might be damaged if care is not taken.

### *NOTES*

Notes call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to ensure accuracy, the information contained herein does not cover all details or variations in hardware and software, nor does it provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein that are not present in all hardware and software systems. GE Electrical Distribution & Control assumes no obligation of notice to holders of this document with respect to changes subsequently made.

GE Electrical Distribution & Control makes no representation or warranty, expressed, implied, or statutory, with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warrantees of merchantability or fitness for purpose shall apply.

# Table of Contents

## Chapter 1 – Product Description



## Chapter 2 – Hardware Description & Specifications



## Chapter 3 – System Interfaces

## Chapter 4 – Settings and Configurations



## Appendix – DMP Protection System Settings

## List of Figures

## 1–1 Introduction

The DMP is a microprocessor-based digital relay system that uses high-resolution waveform sampling of input signals to provide protection, control, and monitoring of three-phase motors. The following three families of DMP relays are available:

- DMP1 – Motor-protection relay system with voltage inputs and motor-control capabilities.
- DMP2 – Motor-protection relay system with voltage inputs.
- DMP3 – Basic motor-protection relay system.

The DMP catalog number system is illustrated inside the front cover.

The DMP1 relay is described in this book. The DMP2 and DMP3 relays are described in GEK–105499.

## 1–2 Applications

The DMP is a compact, protection-based digital system suitable for a range of applications, from low-voltage motor control centers associated with small industrial motors to the largest medium-voltage industrial process motors and utility power plant auxiliary motors in generating stations.

The DMP can be configured for either protection and control or protection-only operation modes. It is primarily used for protection of an induction motor. Additional devices may be required if a DMP is used for synchronous motor protection and control.

For low-voltage applications (up to 750 V), the voltage input signal can be connected directly to the relay. Instrument transformers are used for higher voltage motors. The appropriate protection and control can be configured in the field to suit the specific application. A sampling frequency of 2 kHz provides excellent measurement accuracy.

The DMP system includes an RS–485 serial communication port, as well as multiple inputs and outputs to facilitate remote control and data transfer.

More detailed application considerations are described in this chapter and in *Chapter 4 – Settings and Configurations*.

Figures 1–1 and 1–2 illustrate typical external connections for the DMP1 system. Figures 1–3 and 1–4 illustrate typical connections for some of the commonly used motor starting methods.

## 1–3 Protection

The following protection functions are included in the DMP system. Each of these functions can be individually configured to provide any combination of trip and alarm outputs. The ANSI/IEEE standard device numbers follow each function in parentheses.

### Maximum Start Time (48)

This function provides protection against an incomplete start sequence by comparing the actual motor start time with the set maximum start time. In addition to motor protection, this function can provide protection to the autotransformer/starting reactor in a reduced-voltage motor controller.

### Too Many Starts (66)

This function produces an output when the actual number of starts counted by the DMP within a dynamic time window of specified duration exceeds a set number.

### Thermal Overload (49/51) and Locked Rotor Protection

A thermal model of the motor is incorporated in the DMP system to compute thermal capacity of the motor, based on the motor current and various parameters such as overload pickup, hot/cold ratio, stall time factor, speed switch input, and heating/cooling time factor. The relay computes the thermal capacity on a dynamic basis and is capable of providing a pretrip alarm (Thermal Level 1), in addition to the overload trip (Thermal Level 2) output.

The thermal overload protection function automatically adapts to faster operation, depending on the stall time factor setting and the speed switch input (if available), to provide locked-rotor protection (49S/51) during the motor start. A unique speed-switch-less logic is implemented in the DMP system

to provide the same degree of locked-rotor protection when the speed switch input is not available.

Figure 4–2 and 4–3 contain characteristic curves of the thermal overload function. A reset characteristic is incorporated in this function to model cooling down of the motor. See *Chapter 4 – Settings and Configurations* for details.

### External RTD Interface (49R)

As many as 10 external RTDs can be connected to the DMP system. The RTDs may be either copper (10 Ω), platinum (100 Ω), or nickel (120 Ω) depending on the DMP model. Each of the 10 RTDs incorporates two levels of threshold setting, with a factory-programmed time delay of 2 seconds. Level 1 is intended for and alarm and Level 2 is intended for a trip. The DMP is designed for RTDs having the resistance parameters shown in Table 1–1.

### Overcurrent (51R/50)

Two levels of phase overcurrent protection are implemented, each with its own pickup and time delay settings.

- Level 1 can detect a jam or stall condition (51R) and is active only when the motor is running.
- Level 2 detects a short circuit (50) and is active whenever CURRENT INHIBIT is set to OFF. If a motor contactor is not adequately rated for the available short circuit currents, CURRENT INHIBIT can prevent the contactor's opening when the short circuit current exceeds the CURRENT INHIBIT pickup setting.

### Ground Fault Overcurrent (50G/50N)

Two levels of ground fault overcurrent protection are implemented, each with its own pickup and time delay settings. Level 1 provides an alarm function and Level 2 provides a trip function. Both levels are active whenever CURRENT INHIBIT is set to OFF.

If a motor contactor is not adequately rated for the available short circuit currents, CURRENT INHIBIT can prevent the contactor's opening when the fault current exceeds the CURRENT INHIBIT pickup setting.

Either a residual current circuit or a ground sensor current transformer (CT) circuit can provide the ground current input to the DMP. Figure 1–2 (A & B) illustrates typical connections.

| | Resistance (ohms) | | |
|---|---|---|---|
| ° C | Copper | Platinum | Nickel |
| 0 | 9.035 | 100.000 | 120.000 |
| 10 | 9.421 | 103.902 | 127.168 |
| 20 | 9.807 | 107.793 | 134.518 |
| 30 | 10.194 | 111.672 | 142.060 |
| 40 | 10.580 | 115.539 | 149.801 |
| 50 | 10.966 | 119.395 | 157.746 |
| 60 | 11.352 | 123.239 | 165.900 |
| 70 | 11.738 | 127.072 | 174.268 |
| 80 | 12.124 | 130.893 | 182.849 |
| 90 | 12.511 | 134.702 | 191.639 |
| 100 | 12.897 | 138.500 | 200.640 |
| 110 | 13.283 | 142.286 | 209.854 |
| 120 | 13.669 | 146.061 | 219.290 |
| 130 | 14.055 | 149.823 | 228.949 |
| 140 | 14 442 | 153.575 | 238.836 |
| 150 | 14.828 | 157.315 | 248.950 |
| 160 | 15.217 | 161.043 | 259.296 |
| 170 | 15.607 | 164.759 | 269.894 |
| 180 | 15.996 | 168.464 | 280.770 |
| 190 | 16.386 | 172.158 | 291.949 |
| 200 | 16.776 | 175.839 | 303.455 |

*Table 1–1. Temperature–resistance values for RTDs used in the DMP system.*

### Undercurrent (37)

Two levels of undercurrent protection are implemented, each with its own pickup and time delay settings. Level 1 provides an alarm function, Level 2 a trip function. Both levels are active when the motor is running and both can detect a loss-of-load condition.

The undercurrent function (or underpower, described later) can be used with a submersible pump, in which loss of prime can cause a motor to overheat and fail, or for a broken shaft or conveyor belt application.

### Load Increase (51L)

The load increase protection function operates if the motor current increases above a set value for more than 5 seconds while the motor is running. This

function is useful in cases in which a process may be damaged if a load increases above a certain level, such as in a paper mill, where refiner plates may contact unduly and damage each other.

An output contact can be configured to remove the load to the process long enough for recovery. With the function configured as auto-reset, the loading can be automatically restarted when the condition clears.

### Underpower (32L)

Two levels of underpower protection are implemented, each with its own pickup and time delay settings. Level 1 provides an alarm function, Level 2 a trip function. Both levels are active when the motor is running and both can detect a loss-of-load condition. Underpower protection is functionally equivalent to undercurrent protection, except that it is based on power, rather than current.

### Unbalance Current (46)

Unbalanced currents can be caused by unbalanced voltages in the power system or by a blown fuse in the motor controller and can result in rotor overheating. This function computes the percent of unbalance current and has the time characteristic shown in Figure 4–4. Operation time is inversely proportional to the square of the unbalance current, with a minimum of 1 second. The two levels are set as follows:

- Level 2 trip is set by the customer to the maximum-allowable unbalance current. This function has a slow-reset characteristic to simulate the motor's cooling.
- Level 1 is automatically set at 50% of the level 2 setting, with a delay time of 1 second, and can be used as a pretrip alarm.

### Undervoltage (27)

Power system problems can result in undervoltage conditions that cause increased motor currents. To anticipate motor overheating caused by these currents, the undervoltage function operates when the average of the three line-to-line voltages decreases below a set value. The definite delay time is also set by the customer.

This function is active during the motor's start and run modes and can be used with either three-phase or single-phase voltage signal inputs. Figure 1–2 (C, D, E, & F) illustrates typical connections.

### Overvoltage (59)

Power system problems can cause an overvoltage condition, resulting in excessive excitation current to the motor. An overvoltage condition is detected when the average of three line-to-line voltages increases above the overvoltage setting.

Two levels of overvoltage protection are implemented, with individual time delays.

- Level 1 incorporates a fixed factory-set delay of 1 second and is intended as an alarm.
- Level 2 is intended as a trip function, with pickup level and time delay set by the customer.

Overvoltage protection is active during the motor's start and run modes and can be used with either three-phase or single-phase voltage signal inputs. Figure 1–2 (C, D, E, & F) illustrates typical connections.

### Phase Loss/Phase Sequence (47)

Phase loss protection is activated when the difference in magnitudes of the highest and lowest line-to-line voltages exceeds 20% of the rated line voltage. Phase sequence protection operates when the DMP detects a reverse-voltage sequence. Both functions are implemented with factory-set delay times of 2 seconds.

### External Protective Device Interface

Three contact inputs are provide an interface with external protective devices, such as motor differential relays. These inputs are factory configured in fail-safe mode and will cause a trip or alarm when open.

### Low Power Factor (55)

A combined load of an induction motor and any power factor correction connected to its terminals experiences a decrease in power factor if the correction fails. Also, the power factor of a running synchronous motor decreases in the lagging direction upon loss of field. This protection function provides

an adjustable low lagging-power-factor threshold and adjustable time delay.

### Abnormal Conditions

The following conditions monitored by the DMP can be configured to trip and/or alarm when an abnormality is detected.

- *Communications Port Failure* – A failure of the RS-485 serial link.
- *Internal Failure* – A hardware failure detected during self-test.
- *Control Circuit Open* – A failure of either contactor A or B to operate following a start command from the DMP. The status inputs from both contactors are required.
- *Welded Contactor* – A failure of either contactor A or B to reset following a stop command from the DMP. The status inputs from both contactors are required.

The following conditions result in only a message display on detection of an abnormality. These conditions are monitored only if both Control Circuit Open and Welded Contact monitoring are enabled.

- *Hard-Wired Start* – The status of a contactor changes from reset to operate without a command from the DMP.
- *Hard-Wired Stop* – The status of a contactor changes from operate to reset without a command from the DMP.

## 1–4 Control

The following control functions and features are included with model DMP1 only.

### Local/Remote Control Selection

The DMP can receive motor-control signals (start and stop) from three sources:

- Local start and stop contact inputs
- Progammable logic controller (PLC) start and stop contact inputs
- Serial port commands.

Two inputs, Local/Remote (terminals 4 and 27) and PLC/Serial Port (terminals 5 and 28), determine which of the three sources is allowed to control the motor, as shown in Table 1–2. The two control-selection inputs can be derived from such sources as hard-wired jumpers or a control selector switch. If desired, a door switch of the controller cabinet can be used as part of the Local/Remote input to automatically transfer control to Local mode when the door is open.

| Control Mode | Local/Remote Input | PLC/Serial Port Input |
|---|---|---|
| Local Control – Start | OPEN (Local) | N/A |
| Local Control – Stop | N/A | N/A |
| PLC Control – Start/Stop | CLOSED (Remote) | OPEN (PLC) |
| Serial Port Control – Start/Stop | CLOSED (Remote) | CLOSED (Serial Port) |

*Table 1–2. Input requirements for the possible control modes.*

If an Emergency Stop push button is used, its normally closed contact can be wired in series with the normal Local Stop push button, as shown in Figure 1–1.

### Direct On-Line (DOL) Starting

This is the most commonly used starting method and is also known as full-voltage or across-the-line (ATL) starting. On a successful starting command, the DMP will energize Output Relay A or B to pick up the main motor contactor for a full-voltage start of the motor. Figures 1–3 and 1–4 show typical connection diagram for a motor contactor and a motor breaker, respectively.

### Star (Wye)/Delta Starting

This method reduces inrush current during starting. On a successful start command, the DMP energizes Output Relays A and B for star (wye) and delta connections, respectively, with a set maximum time for star. Output Relay C can be configured to control the main contactor, if used. Figure 1–5 shows typical connections for the wye/delta starting of a motor. The switching from wye (reduced inrush) to delta (normal full voltage) occurs when the inrush current falls below a preset level. *The switching occurs at but not before the preset maximum time, regardless of the inrush current value.*

The star/delta start sequence of DMP output relays A, B, and C can also be used for the reduced-voltage autotransformer starting method, as illustrated in Figure 1–6.

#### Forward/Reverse Starting

The DMP energizes either Output Relay A or B for forward or reverse direction, respectively, based on the start command.

#### Two-Speed Starting

This feature can start and protect a two-speed motor, at either of the two speeds, with a single DMP. Output Relay B is used for slow-speed contactor control and Output Relay B for high-speed contactor control.

#### PLC Control

Dedicated PLC contact inputs can be configured to accept PLC commands to individually control Contactors A and B and reset the relay following an operation.

#### RS–485 Serial Port Control

The DMP can be configured to accept commands from an RS–485 port and to send data on the serial link to a remote computer for a motor management system. *Chapter 3 – System Interfaces* contains the details on this feature.

#### Start Prevent Following a Trip

Unless configured for Auto Reset, the DMP requires a reset signal following any trip before it will accept any start commands. In addition, the DMP control logic will prevent a reset unless the following conditions are satisfied.

- Following a Thermal Level trip, the DMP will prevent starting and relay reset until the motor is cooled to 50% of its thermal capacity.
- Following a Too Many Starts trip, the DMP will prevent starting and automatic reset (if so configured) for an adjustable (Start Inhibit) time delay.

The waiting time (Time To Start) for these conditions may be displayed on the DMP.

#### Start Prevent on System Not Ready

The DMP will prevent the motor from starting under the following conditions:

- The motor bus voltage is below the U/V STRT PREVENT set point.
- The logic input contacts indicate an open isolator switch, external trip, stop command, plant interlock contact open, or a control selection inconsistent with the start command.

#### Auto-Reset

The DMP1 will automatically restart the motor following a momentary loss of power. The restart will either be instantaneous of after a set time delay, depending on the duration of the power loss. This restart delay can be used to stagger the starting of multiple motors affected by a momentary disturbance, to minimize the effect on the power system.

## 1–5 Additional Features

### Inputs

The DMP can be powered from either an ac or dc source, depending on the model.

The DMP accepts four current (three phase and one ground) and three voltage signal inputs. The ground current input can be derived from either residual current circuit connections or from a ground sensor CT, as shown in Figure 1–2 (A & B). Both 1 ampere and 5 ampere current input terminals are available to match the CT secondary rating.

Voltage inputs to the DMP are provided on models DMP1 and DMP2. Figure 1–2 (C, D, E, & F) show different connections for the available voltage input signals. Three-phase, three- or four-wire voltage signals, derived from delta- or wye-connected voltage transformers (VTs), shown in Figure 1–2 (C & D), can be connected to the DMP for proper operation of all the voltage-dependent functions. For low-voltage applications (up to 750 V), the motor voltage can be connected directly to the DMP, as shown in Figure 1–2 (F).

If the three-phase voltage signal is *not* connected to the DMP, the voltage-dependent protection func-

tions—Phase Loss/Phase Sequence (47), Low Power Factor (55), and Underpower (32L)—are unavailable and must be disabled. (See *Chapter 4 – Settings and Configurations* for details.) In addition, some measured data, such as volts, watts, vars, and power factor, are also unavailable.

Figure 1–2 (E) shows the recommended connection when only a single-phase voltage signal is available. This connection allows use of the protection functions Undervoltage (27), including Undervoltage Start Prevent, and Overvoltage (59). The Frequency Tracking feature, described later, is also available. If *no* voltage signal is available, the Undervoltage and Overvoltage functions must also be disabled. (See *Chapter 4 – Settings and Configurations* for details.)

In addition to the 10 RTDs mentioned earlier, there are 20 Logical Inputs (contacts) available. Table 1–3 contains functional descriptions of these inputs

### Outputs

There are four configurable output relays (A, B, C, and D), each with one trip-rated Form C contact. The available configurations for each relay are described below.

**Relay A** – This output is automatically configured, depending on the starting method, as described in *Chapter 2 – Settings*. The possible configurations for this output relay are the following:

- Direct-on-line (DOL)/full-voltage contactor control.
- Star (wye) contactor control for the Star (Wye)/Delta starting method.
- Forward contactor control for the Reversing starting method.
- High-speed contactor control for the Two-Speed starting method.

**Relay B** – This output is automatically configured, depending on the starting method, as described in *Chapter 4 – Settings and Configurations*. The possible configurations for this output relay are the following:

- Direct-on-line (DOL)/full-voltage contactor control.
- Delta contactor control for the Star (Wye)/Delta starting method

| *No. of inputs* | *Description of input* |
|---|---|
| 1 | Authorized key-switch input for security against unauthorized setting changes and DMP resetting. |
| 1 | Speed-switch contact input. Provides indication of rotation during motor starting, used by the DMP to determine the appropriate overload characteristic during startup. See *Chapter 4 – Settings and Configurations* for a unique speed-switchless logic to supplement the speed-switch input. |
| 3 | External protective device "fail-safe" contact inputs (External Fault 1, 2, 3). |
| 3 | Local control contact inputs (Contactor A START, Contactor B START, and STOP control). |
| 1 | External lockout contact to block operation of the motor. A fail-safe input contact that must be closed to permit motor operation. |
| 2 | Control mode selection inputs. Determine Local/PLC/Serial Port motor control (Table 1–2). |
| 3 | Control contacts from PLC output (Contactors A & B and DMP reset control). |
| 6 | Position status inputs of Contactors A & B and Isolator Switch (NO & NC contact from each of the three devices). |

*Table 1–3. DMP system logic inputs.*

- Reverse contactor control for the Reversing starting method.
- Low-speed contactor control for the Two-Speed starting method.

Output Relays A and B provide fail-safe operation when the DMP is used for motor start and stop control. Once picked up at the end of a successful start sequence, Relay A or B remains picked up until the DMP receives a stop command or a trip occurs. Any interruption in the DMP power supply may drop these relays out and stop the motor (see the description of U/V Auto Restart in *Chapter 4 – Settings and Configurations*).

**Relay C** – This output can be configured by the customer as one of the following. Refer to *Chapter 4 – Settings and Configurations* for details.

- An alarm (fail-safe).
- A slave to one of Relays A or B.
- To control a line contactor for Star (Wye)/Delta starting.

**Relay D** – This output can be configured by the customer as one of the following. Refer to *Chapter 4 – Settings and Configurations* for details.

- A trip (fail-safe or nonfail-safe).
- A slave to one of Relays A or B.

### Self-Tests

The DMP performs extensive self-tests during power-up and on a manual Self Test command from the Test/Maintenance Options menu.

The DMP also performs continuous background self-tests, as a lower priority than the protection and control functions. Any unsuccessful self-test is reported as Internal Failure and be configured as an alarm or trip. Refer to *Chapter 4 – Settings and Configurations* for details.

### Frequency Tracking

The DMP automatically tracks power system frequency over the range of 45–65 Hz to compensate for any deviation from the nominal frequency of 50 or 60 Hz. This feature maintains the measurement accuracy of the analog inputs and the sensitivities of the protection functions over the range of power system frequencies. The motor voltage (single or three phase) is required as an input for proper operation of this feature. If no ac voltage is connected, the DMP assumes that the actual frequency is the same as the nominal power system frequency.

### Operating Data (Normal and Fault)

The DMP can report a variety of normal and fault data related to motor operation. These data are characterized as Measured, Calculated, Statistical, or Fault. The status of the contact inputs can also be reported. Refer to *Chapter 3 – System Interface* for details.

### Local User-Machine Interface (UMI)

The local UMI includes a key pad, back-lit liquid crystal display (LCD), and nine LED monitors for entering settings, displaying present metering data, viewing fault target information, and accessing stored data. The UMI is described in *Chapter 3 – System Interfaces*.

### Remote Communications

The standard RS–485 port can be used for communication between the DMP and a remote PC. The serial port allows remote motor control, setting changes, and viewing of any data stored in the DMP. Refer to *Chapter 3 – System Interfaces* for details.

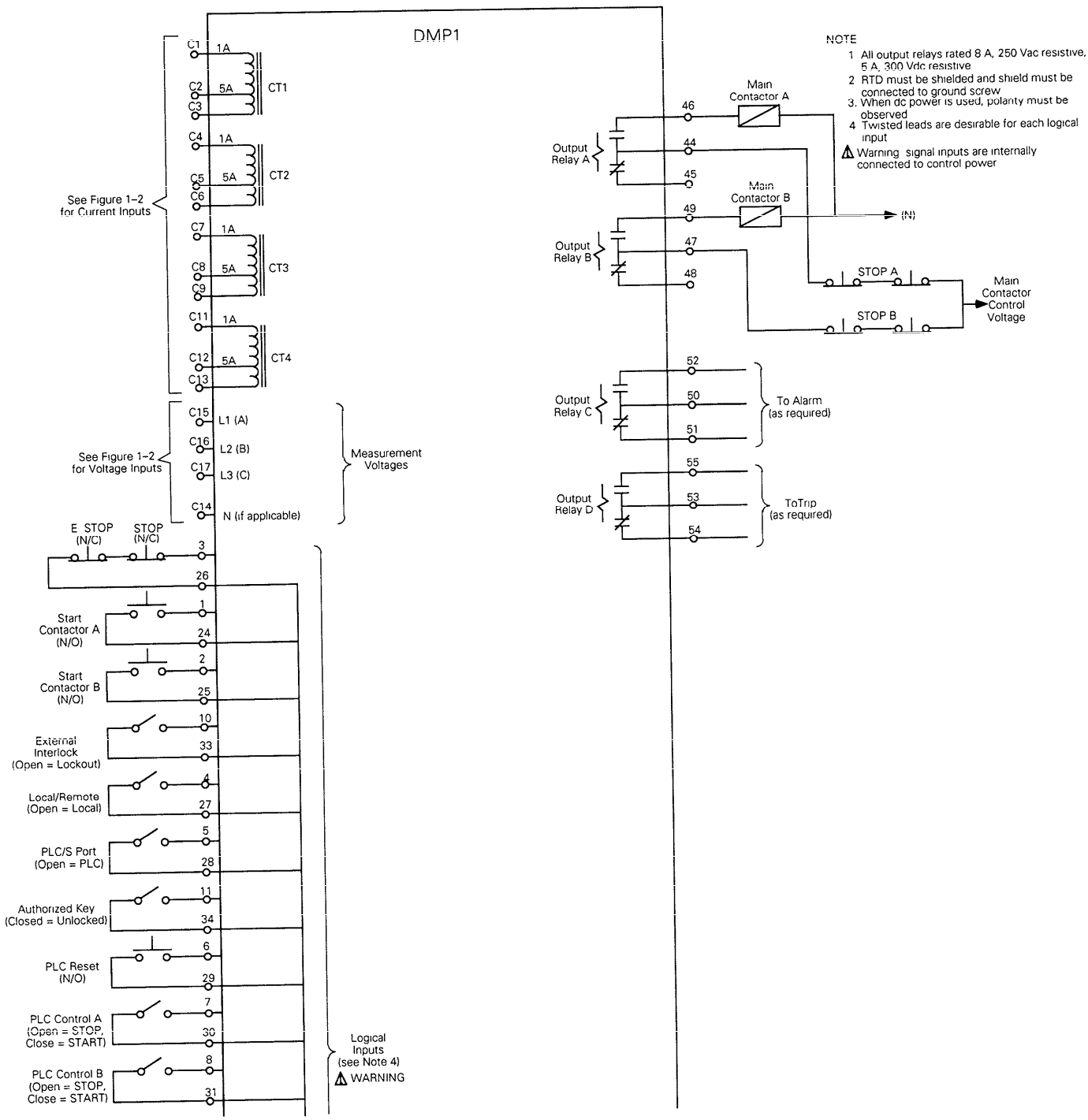



*Figure 1–1. Typical external connections to the DMP system.*

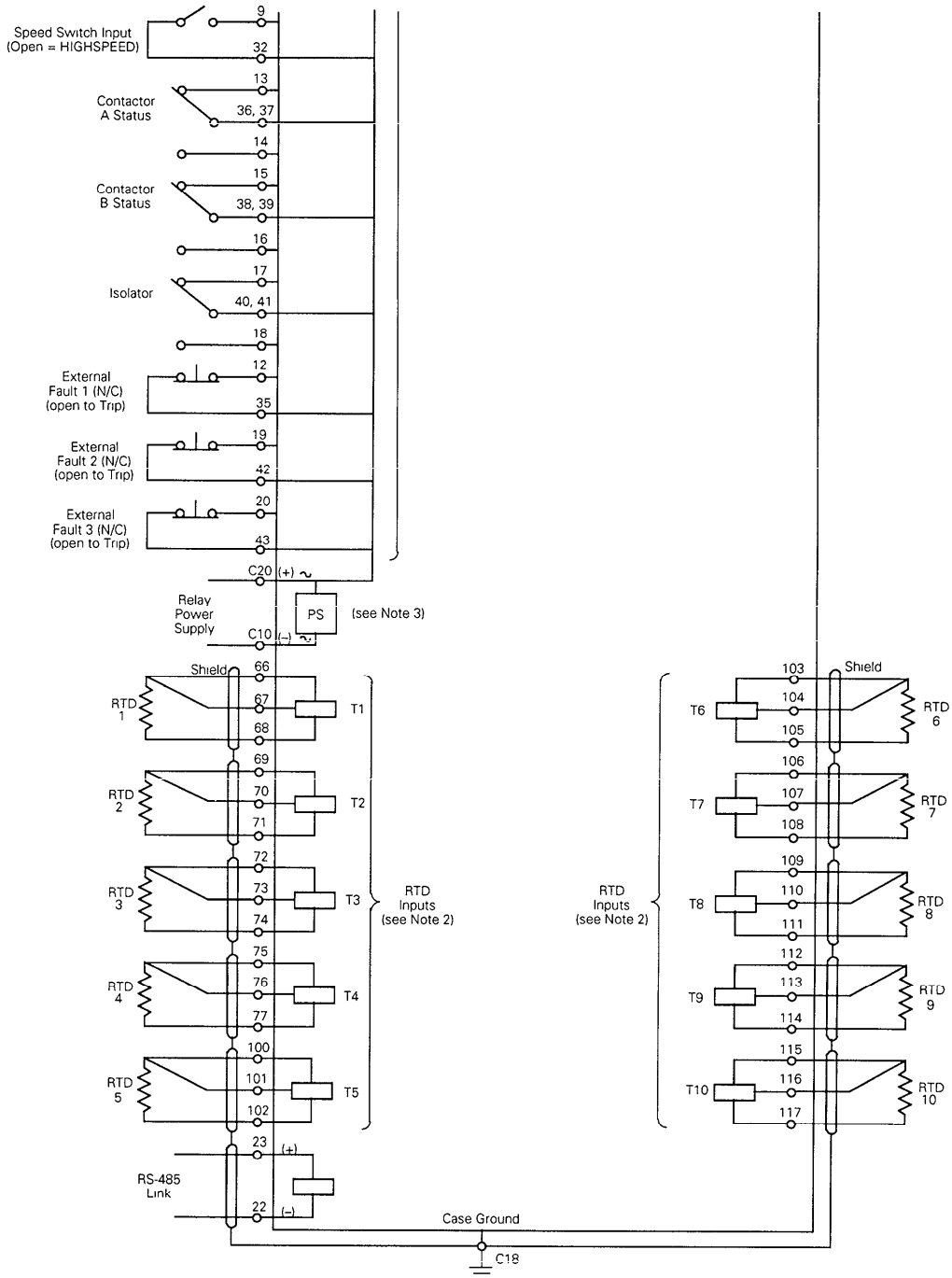



*Figure 1–1. Typical external connections to the DMP system (cont).*

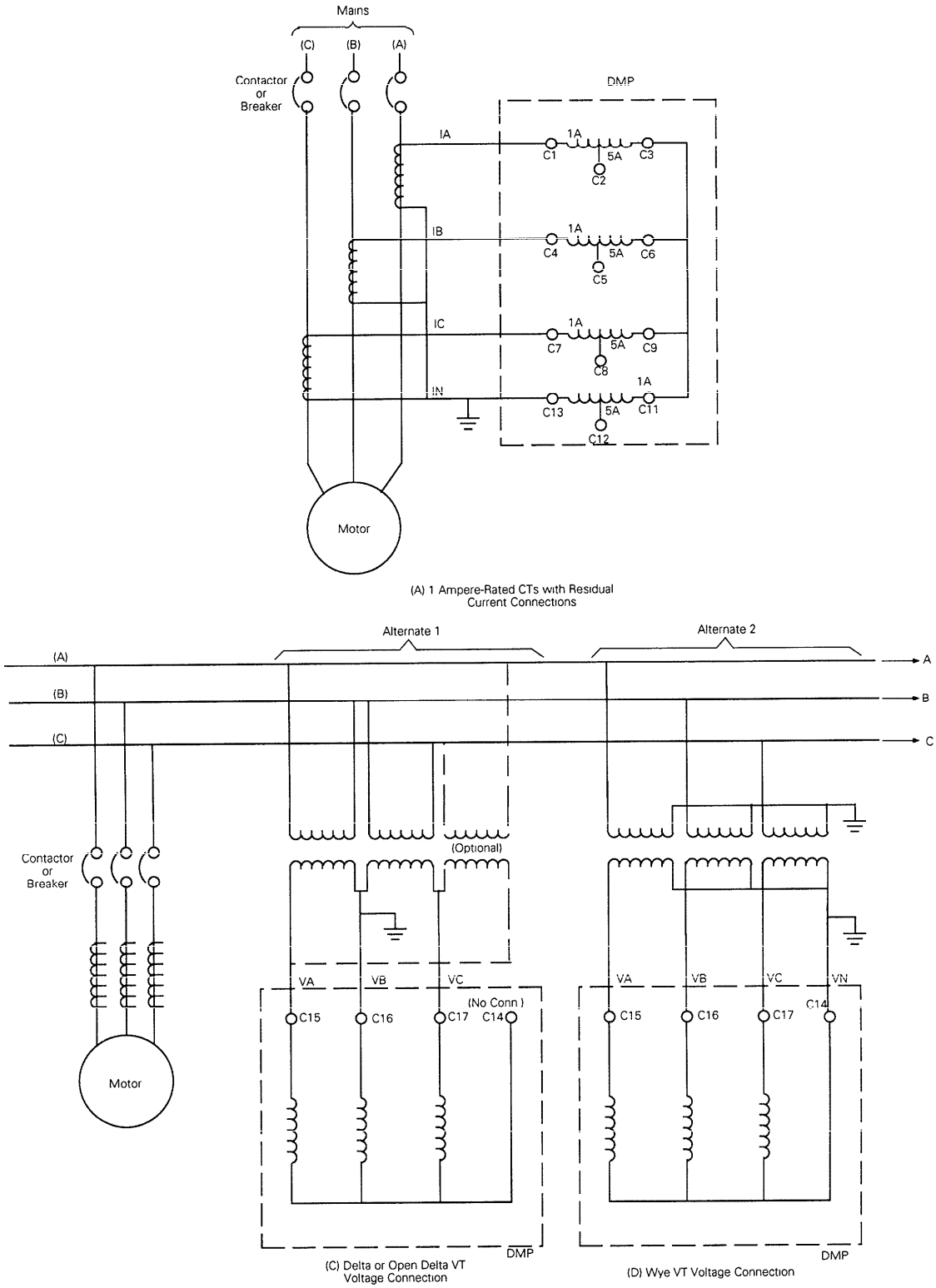



*Figure 1–2. Typical external current and voltage connections to the DMP system.*

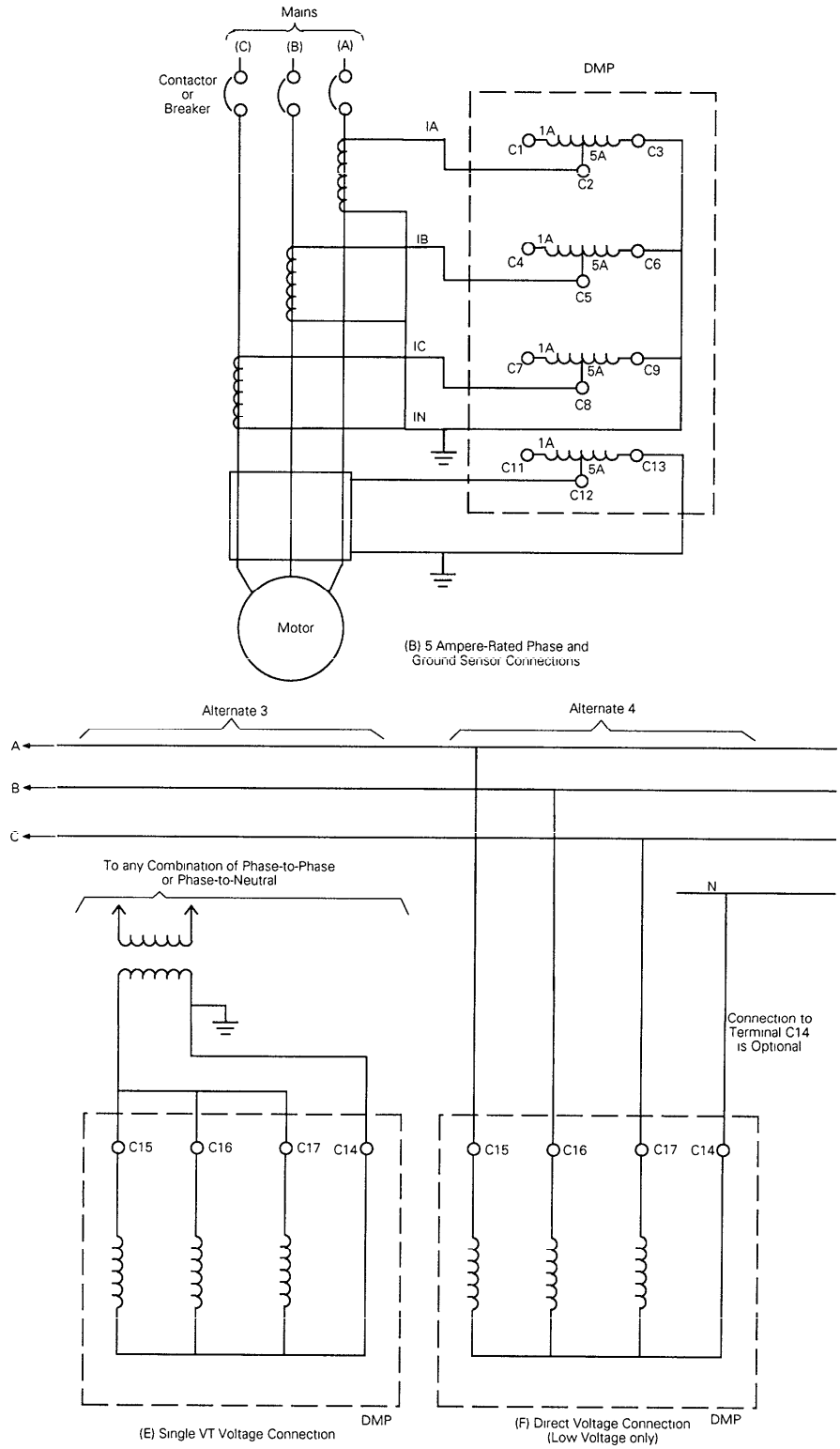



*Figure 1–2. Typical external current and voltage connections to the DMP system (cont).*

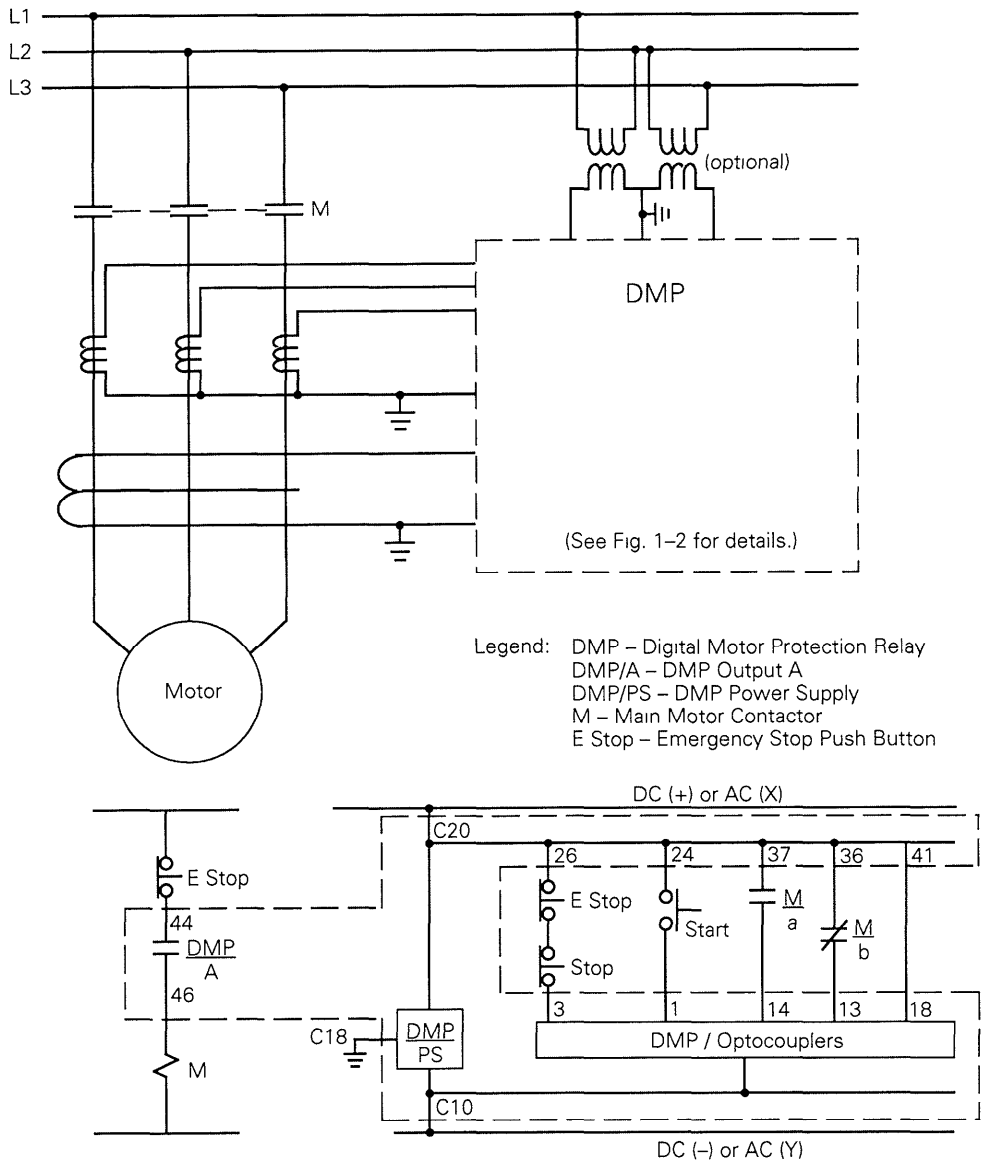



*Figure 1–3. Partial connection diagram—across-the-line starting using motor contactor.*

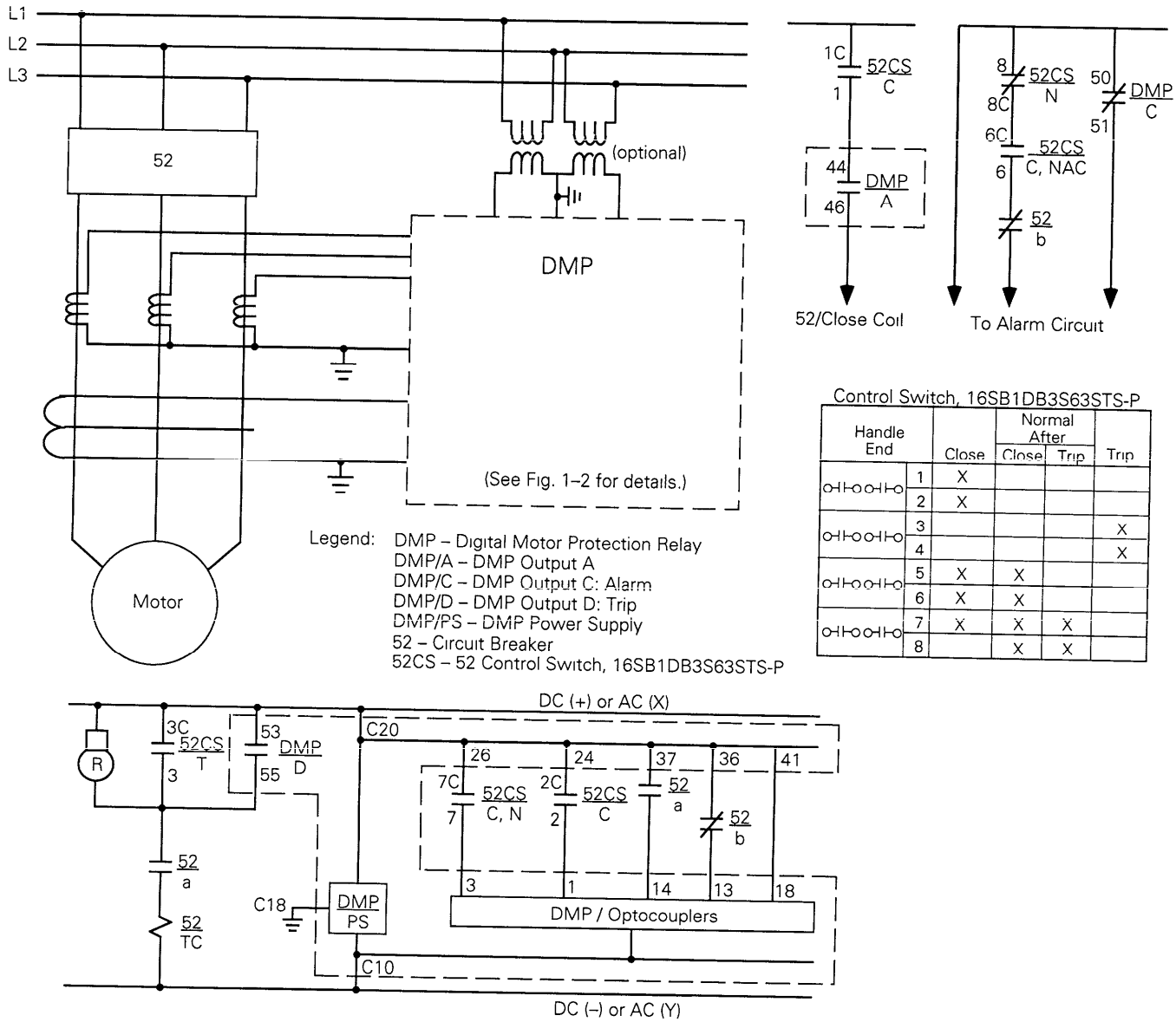
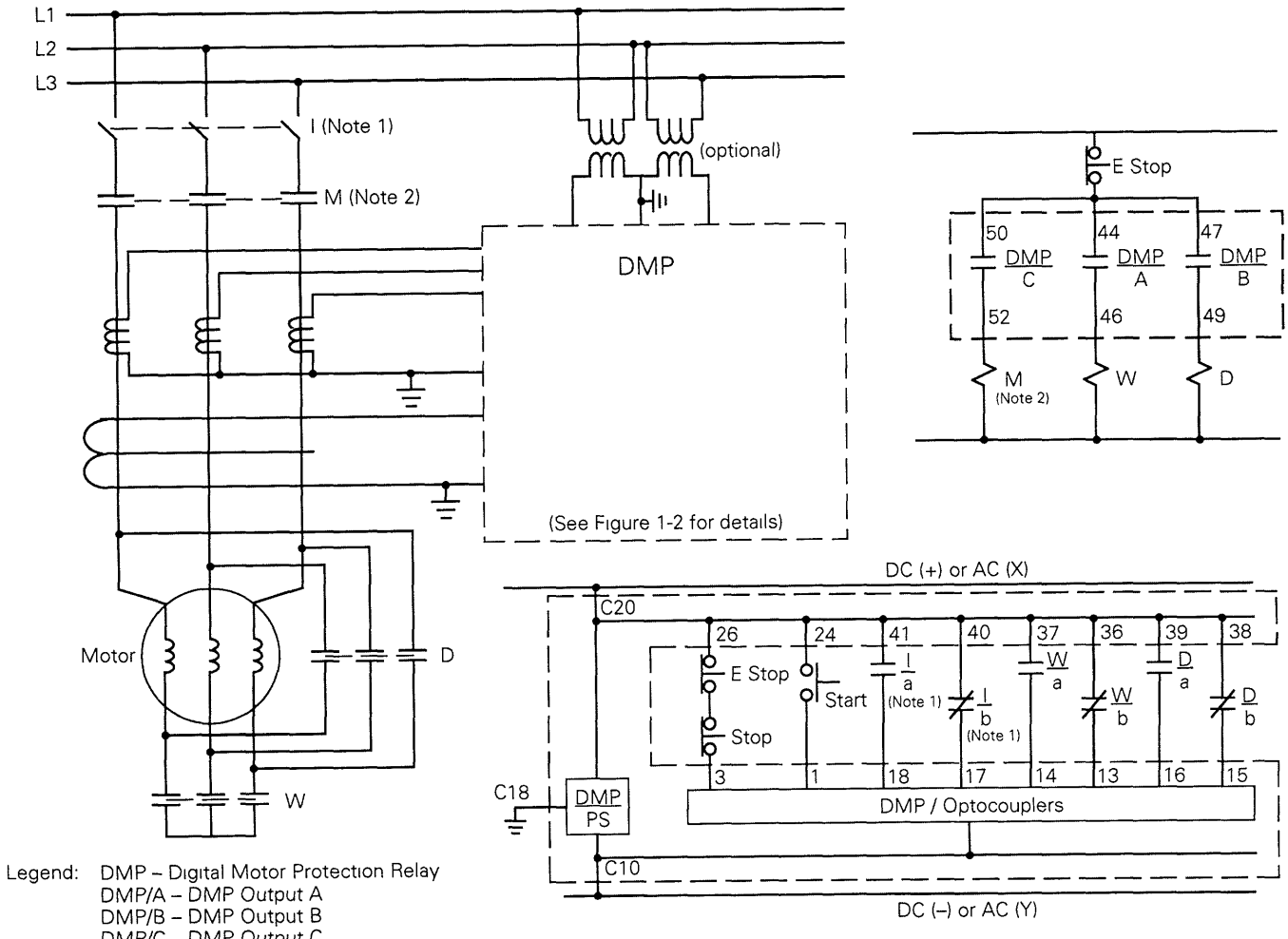


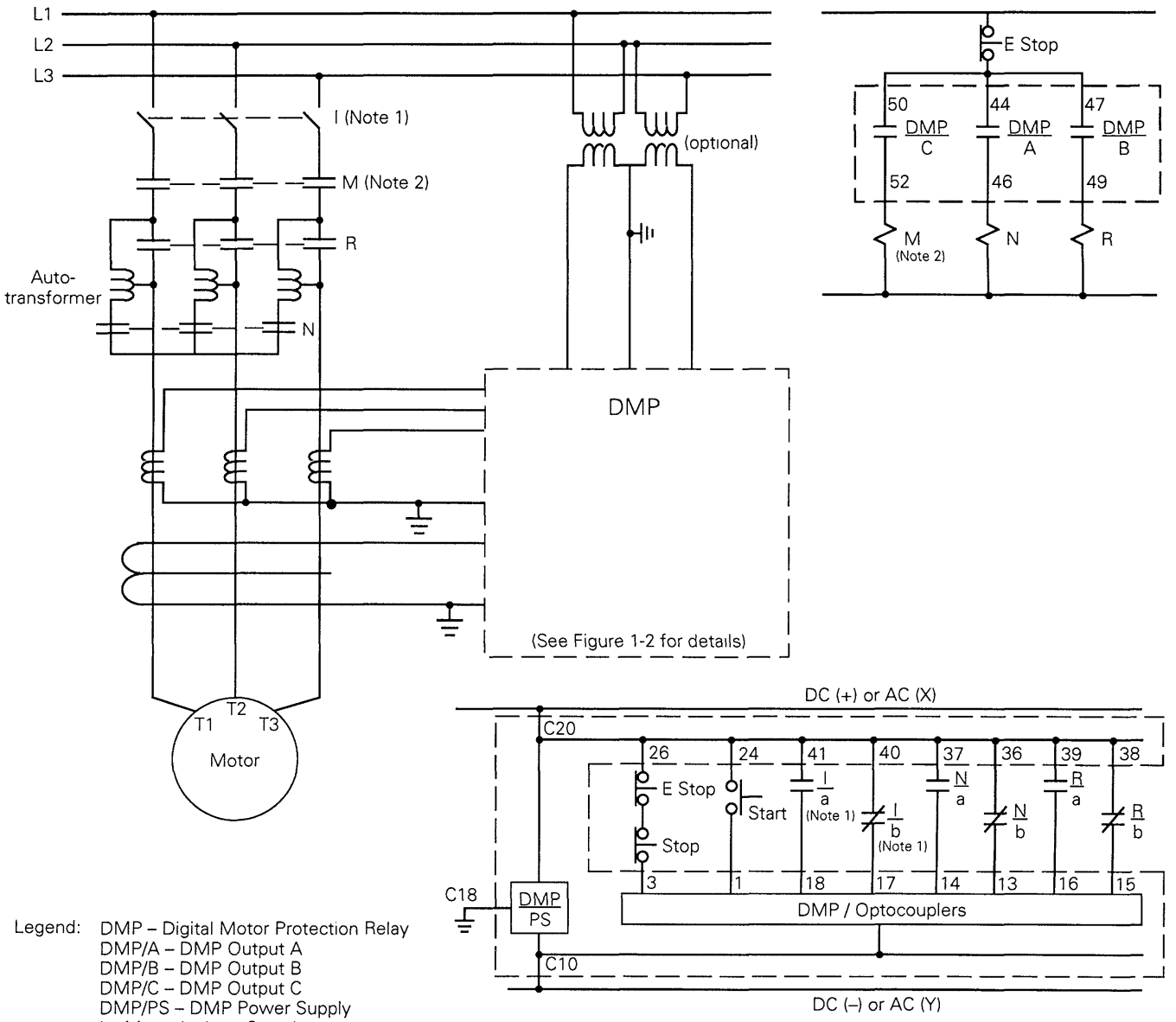

*Figure 1–4. Partial connection diagram—across-the-line starting using motor breaker.*




Legend: DMP – Digital Motor Protection Relay
DMP/A – DMP Output A
DMP/B – DMP Output B
DMP/C – DMP Output C
DMP/PS – DMP Power Supply
I – Motor Isolator Switch
M – Main Motor Contactor
W – Motor Starting Contactor (Wye)
D – Motor Running Contactor (Delta)
E Stop – Emergency Stop Push Button

Notes:
1. Isolator switch I is optional. DMP Inputs 41 & 18 must be shorted and Inputs 40 & 17 must be open if the switch I is not used.
2. Main contactor M is optional. If it is used, it can be controlled by DMP Output C (configured to Start/Run) as shown.

*Figure 1–5. Partial connection diagram—wye/delta starting using motor contactors.*




Legend:
- DMP – Digital Motor Protection Relay
- DMP/A – DMP Output A
- DMP/B – DMP Output B
- DMP/C – DMP Output C
- DMP/PS – DMP Power Supply
- I – Motor Isolator Switch
- M – Main Motor Contactor
- N – Motor Starting Contactor: Neutral
- R – Motor Running Contactor
- E Stop – Emergency Stop Push Button

Notes:
1. Isolator switch I is optional. DMP Inputs 41 & 18 must be shorted and Inputs 40 & 17 must be open if the switch I is not used.
2. Main contactor M is optional. If it is used, it can be controlled by DMP Output C (configured to Start/Run) as shown.

*Figure 1–6. Partial connection diagram—reduced-voltage autotransformer starting method.*

This chapter contains descriptions of the DMP hardware and the DMP system technical specifications

## 2–1 Hardware Description

### Case Assembly

The DMP is available with three different cases: drawout, fixed vertical, and fixed horizontal. These are described below.

#### Drawout Case

The drawout case is an M–2 case with a cutout for accessing the control inputs, RTDs, and trip and alarm contacts. The dimensions for panel and semiflush mounting are shown in Figure 2–1.

#### Fixed Vertical and Horizontal Cases

The fixed vertical and horizontal cases have the same dimensions, as shown in Figure 2–2. The longest dimension determines whether the mounting is vertical or horizontal. The fixed vertical and horizontal cases must be unwired before the DMP can be removed from the system.

### Identification

The DMP model number is located on the front cover. See the *Getting Started* section to determine the configuration of your unit.

Terminals for input and output are labeled on the rear of the case. These are illustrated in Figure 2–3 for the drawout case and Figure 2–4 for the fixed vertical and horizontal cases.

### Receiving and Handling

The equipment should be unpacked and examined for shipping damage immediately upon receipt. If damage is evident, file a claim at once with the shipping company and notify the nearest ED&C sales office.

If the equipment is not to be installed immediately, store it indoors in a dry location that is protected from dust, metal chips, and severe atmospheric conditions.

### Mounting

The DMP can be mounted in a standard rack. For mounting dimensions, refer to Figure 2–1 for a drawout case or Figure 2–2 for a fixed case.

### Surge Ground Connections

Terminal C18 on the rear of the DMP is provided for surge ground connections. This terminal is also for connecting the shields of the RTDs and the communication cable. The drawout case has an additional surge ground stud on the rear of the case. #10 AWG wire should be used to connect the DMP to ground.

## 2–2 Technical Specifications

Table 2–1 contains the electrical ratings for the DMP, Table 2–2 contains contact ratings, and Table 2–3 contains accuracies for the measured and calculated parameters.

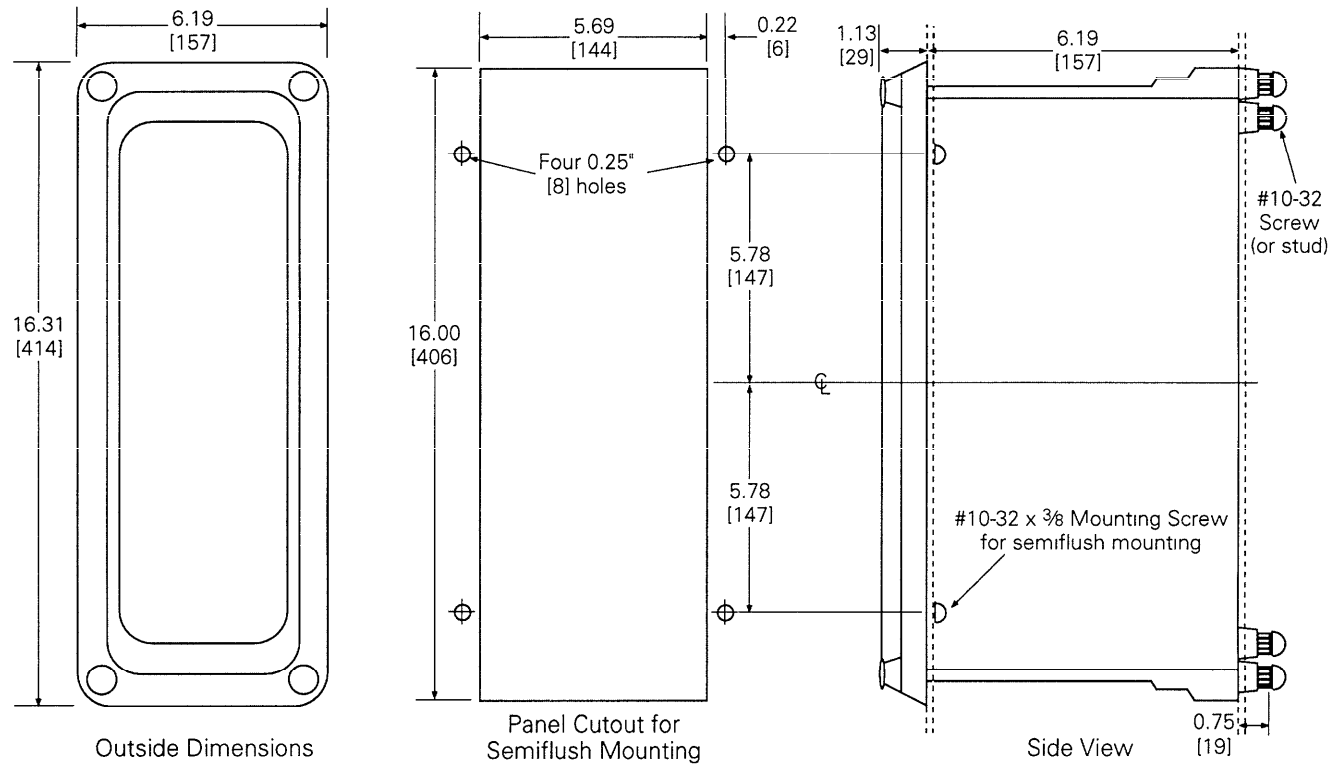



*Figure 2–1. Case and mounting dimensions in inches [mm] for the DMP in a drawout case.*

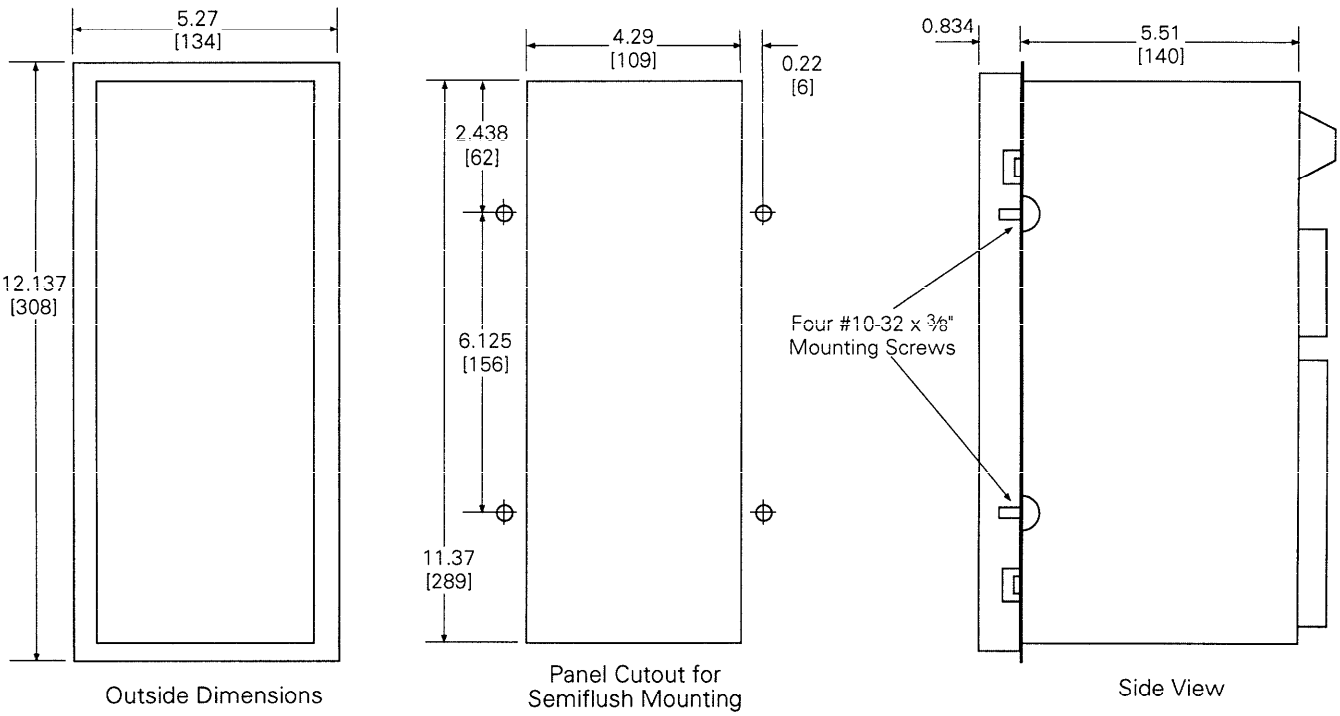



*Figure 2–2. Case and mounting dimensions in inches [mm] for the DMP in a fixed vertical or horizontal case.*

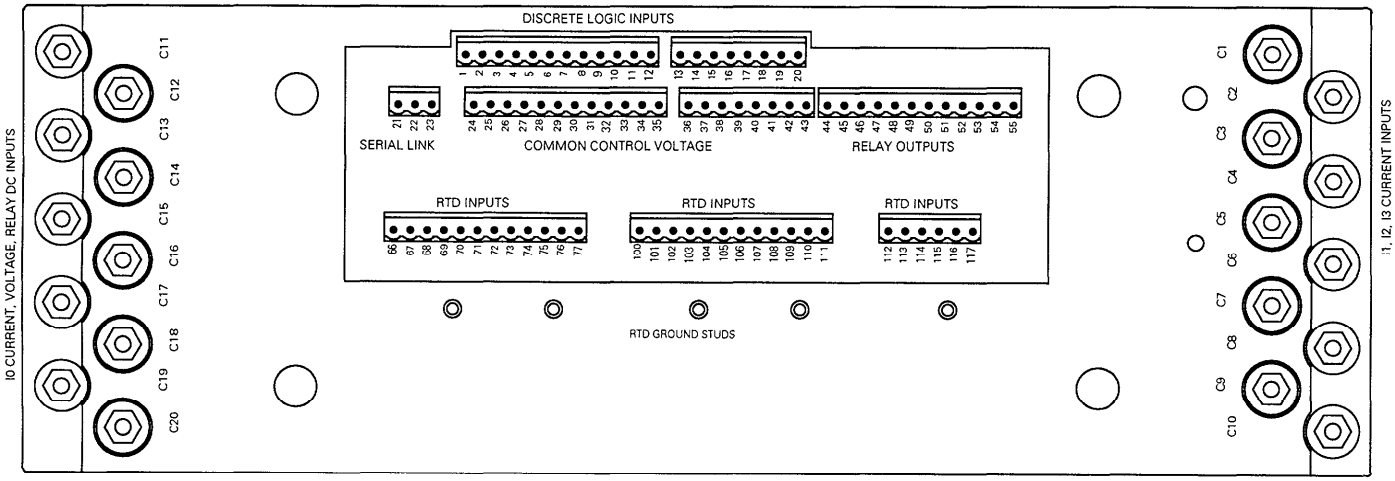



*Figure 2–3. Input and output terminals on the rear of the drawout case.*

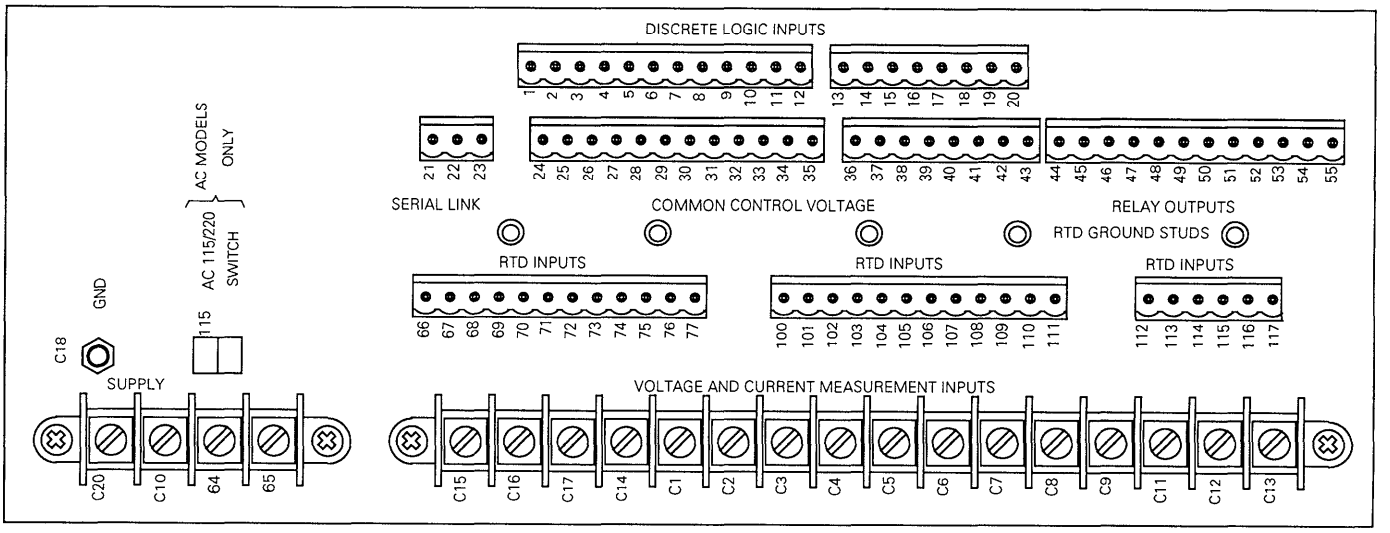



*Figure 2–4. Input and output terminals on the rear of the fixed horizontal and vertical cases.*

| ***Parameter*** | ***Rating*** |
|---|---|
| Frequency | 50 or 60 Hz, software selectable |
| Rated current | 1 ampere<br>5 ampere with 5 A tap |
| Rated voltage | 50–750 Vac phase-to-phase |
| Maximum permissible current, 1 A rated CT<br>Continuous<br>2 sec<br>1 sec | <br>3X rated current<br>30X rated current<br>50X rated current |
| Maximum permissible current, 5 A rated CT<br>Continuous<br>2 sec<br>1 sec | <br>3X rated current<br>30X rated current<br>100X rated current |
| Maximum permissible ac voltage | 750 Vac phase to phase<br>380 Vac phase to neutral |
| Burden – phase & ground per CT, 1 A rated CT<br>Applied current<br>VA<br>Input impedance | <br>1 A<br>≤ 0.1 VA<br>≤ 100 mΩ |
| Burden – phase & ground per CT, 1 A rated CT<br>Applied current<br>VA<br>Input impedance | <br>5 A<br>≤ 0.5 VA<br>≤ 20 mΩ |
| dc power supply<br>24–48 Vdc<br>125–250 Vdc<br>Burden | <br>range: 19–60 Vdc<br>range: 85–300 Vdc<br>≤ 20 VA |
| ac power supply<br>Switch at 115 Vac<br>Switch at 220 Vac<br>Burden | <br>80–135 Vac<br>160–270 Vac<br>≤ 20 VA |
| Impulse | Meets IEC 255–4 (1976) & Amend #1 (1979)<br>Meets IEC 255–5 (1977)<br>5 kV common-mode test<br>5 kV transverse-mode test |
| Dielectric strength | 2500 Vac for 1 min. common mode, between ground and<br>– current inputs<br>– voltage inputs<br>– auxiliary power supply inputs<br>– control terminals<br>1.5 Vac for 1 min. transverse mode, between each of the above circuits |

*Table 2–1. Electrical ratings of the DMP system.*

| Parameter | Rating |
|---|---|
| Dielectric strength | 2500 Vac for 1 min. common mode, between ground and<br>– current inputs<br>– voltage inputs<br>– auxiliary power supply inputs<br>– control terminals<br>1.5 Vac for 1 min. transverse mode, between each of the above circuits |
| Surge withstand<br>Oscillatory<br>Fast transient<br>In accordance with: | <br>2.5 kV peak<br>4 kV crest voltage<br>ANSI C37.90.1 (1990), IEC 255–4 (1976) & Amend #1 (1979) Class III, IEC 255–22–2 (1988) Class III |
| Radio frequency interference | In accordance with EMI standard ANSI C37.90.2 |
| Ambient temperature range | Operating: –20° to +65° C<br>Display: –20° to +60° C |
| Humidity | 95% without condensation |

*Table 2–1. Electrical ratings of the DMP system (cont.).*

| Parameter | Rating |
|---|---|
| Closing | Close and conduct to a maximum of 30 A for tripping duty (5 cycles) at control voltages to 300 Vdc. |
| Continuous | 5 A at 300 Vdc maximum |
| Interrupting | ac inductive load PF = 0.4<br>dc resistive load L/R = 40 ms |
| ac inductive load | 120 Vac, 8 A<br>240 Vac, 7.5 A |
| ac resistive load | 120 Vac, 10 A<br>240 Vac, 8 A |
| dc inductive load | 48 Vdc, 0.7 A<br>125 Vdc, 0.3 A |
| dc resistive load | 48 Vdc, 1 A<br>125 Vdc, 0.4 A |

*Table 2–2. DMP contact ratings.*

| Parameter | Rating |
|---|---|
| Voltage | |
| Method | True rms, 0.5 ms sample time |
| Accuracy | ±1% |
| Current | |
| Method | True rms, 0.5 ms sample time |
| Accuracy | ±1.5% for 0.9–1.5 X CT primary amps setting<br>±5% above 1.5 X primary amps setting<br>±3% + 0.02 X primary amps setting below 0.9 X CT setting |
| Power | |
| Method | Total of three phases |
| Range | 0–65 MW |
| Full scale | 65 MW |
| Accuracy | ±3% |
| Reactive power | |
| Method | Total of three phases |
| Range | 0–65 MVARS |
| Full scale | 65 MVARS |
| Accuracy | ±3% |
| Power factor | |
| Method | Total of three phases |
| Range | 0–1 |
| Full scale | 1 |
| Accuracy | ± 3% |
| RTD inputs | 10 three-wire RTDs |
| Range | 0–200° C |
| Accuracy | ±3% of resistance |
| Time delay | 2.0 ±1.0 s |
| Maximum wire resistance | 25% of RTD at 0° C |
| RTD types | 10 Ω Cu, 100 Ω Pt–120 Ω Ni |
| Thermal overload curves | |
| Fault-time accuracy | ±1 s up to 10 s<br>±2% above 10 s |
| Threshold current level | Overload setting ±1.5% |
| Unbalanced trip & alarm | |
| Method | Unbalance = $100 \frac{I_{max} - I_{min}}{I_r}$ [%]<br>$I_{max}$ = max of phase currents<br>$I_{min}$ = min of phase currents<br>$I_r$ = Larger of ($I_{max}$, motor FLC)<br>($I_r$ used to prevent unnecessary tripping at low currents) |
| Alarm | |
| Unbalanced alarm threshold level | 50% of unbalanced setting ±2% |
| Fixed delay time | 1.0 ±0.5 s |
| Trip | |
| Unbalanced alarm threshold level | Unbalanced current setting ±2% |
| Fixed delay time | ±1 s to 10 s, ±1 s ±2% above 10 s |
| Fault time delay accuracy | ±0.5 s or 2% of setting, whichever is greater |
| Exceptions to above | |
| Overcurrent level 2 (short) | 60 ms ±20 ms when adjusted to 0<br>–0.1/+0.2 s for delay < 1 s |
| Ground fault trip | –0.1/+0.2 s for delay < 1 s |

*Table 2–3. DMP measured and calculated data accuracy ratings.*

This chapter contains descriptions of all external interfaces to the DMP system.

## 3–1 Front Panel

The DMP front panel, shown in Figure 3–1, encompasses nine LEDs, a two-line by 16-character back-lit LCD, and nine keys.

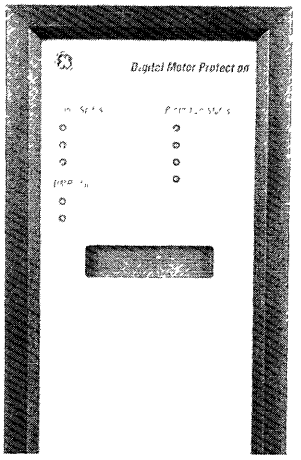


*Figure 3–1. DMP front panel.*

### LEDs

The LEDs indicate the DMP, motor, and protection status. The DMP makes logical decisions based on the motor's input parameters and the DMP control inputs. To fully understand the information displayed by the LEDs, you must be familiar with the DMP logical inputs (START commands and contactor inputs) and the motor starting process. See the descriptions of the logical inputs and contact status later in this chapter.

### Motor Status LEDs

STOPPED – This LED lights when both relays A and B are de-energized. LEDs A and B normally indicate the status of output relays A and B. These relays typically control contactors A and B and are de-energized when a fault is detected or when a STOP input is sensed.

STARTING – This LED lights when the motor current exceeds 115% of FLC after a successful START command has been initiated. See the *Other Control Features* section in *Chapter 1 – Product Description* for various start-prevention conditions.

RUNNING – This LED lights when the motor has completed the starting process. This occurs when the average motor current falls below 115% of FLC.

When the control inputs are switched to RUN ENABLE and the motor input current stays above 115% of FLC, the DMP will not switch to RUN when a START command is initiated at the control inputs. However, the STARTING LED lights to indicate a starting process. The RUNNING LED lights when the motor starting process is complete and a START command is initiated.

### Protection Status LEDs

A – This LED lights when relay A is energized. This relay typically controls contactor A.

B – This LED lights when relay B is energized. This relay typically controls contactor B.

ALARM – This LED lights when the DMP senses a programmed alarm condition. If the fault sensed by the DMP disappears, the LED remains lit until the DMP is reset.

TRIP – This LED lights when the relay senses a programmed trip condition. If the fault sensed by the DMP disappears, the LED remains lit until the DMP is reset.

### DMP Status LEDs

SERVICE – This LED lights when the DMP self-test determines that it is not functioning properly. Contact your local ED&C sales office to return the DMP for service.

ON – This LED lights when the DMP is energized.

## Key Pad

The DMP's key pad allows you to change DMP parameter settings by scrolling through two levels of screens, which appear on the LCD. To view the top level press the SET MENUS, DATA MENUS, or TEST MENUS key. Each of these menus has a number of categories that are displayed by pressing the appropriate menu key.

To scroll through the items in a menu category, press the ITEM ↑ or ITEM ↓ key. You can jump to the top level of the current menu or to a different menu at any time by pressing the appropriate menu key.

Any of the settings displayed by the SET MENUS key can be changed by pressing the VALUE ↑ or VALUE ↓ key. After changing a setting, press the STORE key to save the change. If you change to a different menu category before storing a changed setting, it will be lost. You can, however, change multiple settings within the same menu category, then press STORE once before leaving that category.

The RESET key resets the DMP. Pressing the RESET key twice within one second resets the thermal capacity. Thermal capacity can only be reset on the front panel.

### Top-Level Screen Keys

DATA MENUS – This key scrolls the display through the Data menu categories.

SET MENUS – This key scrolls the display through the Settings menu categories.

TEST MENUS – This key scrolls the display through the Test menu categories.

### Sublevel Screen Keys

ITEM ↑ and ITEM ↓ – These keys advance the display in the selected sublevel category.

VALUE ↑ and VALUE ↓ – These keys change the setting value of the item currently displayed.

### Keys Usable on All Levels

STORE – This key stores changed settings in non-volatile memory. You must store a changed setting before moving to another level. For example, if you change drive number and baud rate in the Communications Settings menu, press STORE before moving to another Settings page, such as Voltage Settings.

RESET – This key resets the DMP or, if pressed twice within one second, resets the thermal capacity. A DMP RESET is only enabled when the LOCAL/REMOTE logical input is open. A RESET is not accepted during an effective START command. A thermal capacity reset is enabled whenever the AUTHORIZED key is closed.

## 3–2 Display Menus and Messages

This section describes the Data, Settings, and Test menus and other messages that may appear on the display.

### Data Menus

The categories available under the Data menu are Measured Data, Calculated Data, Logical Inputs and Contact Status, Statistical Data, and Fault Data. Figure 3–2 shows the sequence of menu items under each category of the Data menu. The menu items in each category are described in Tables 3–1, 3–2, 3–3, 3–4, and 3–5.

*NOTE:* Any menu item can be displayed continuously. Press the STORE key when the desired item is displayed. DATA STORED OK will momentarily appear on the display, then the selected data item will appear whenever the display is not being used for another function.

*NOTE:* Tout item du menu peut être configuré pour s'afficher de manière continue. Appuyer sur la touche STORE lorsque l'item désiré est affiché. Les mots DATA STORED OK apparaîtront momentanément à l'affichage, puis les données de l'item sélectionné apparaîtront lorsque l'affichage n'est pas utilisé pour une autre fonction.

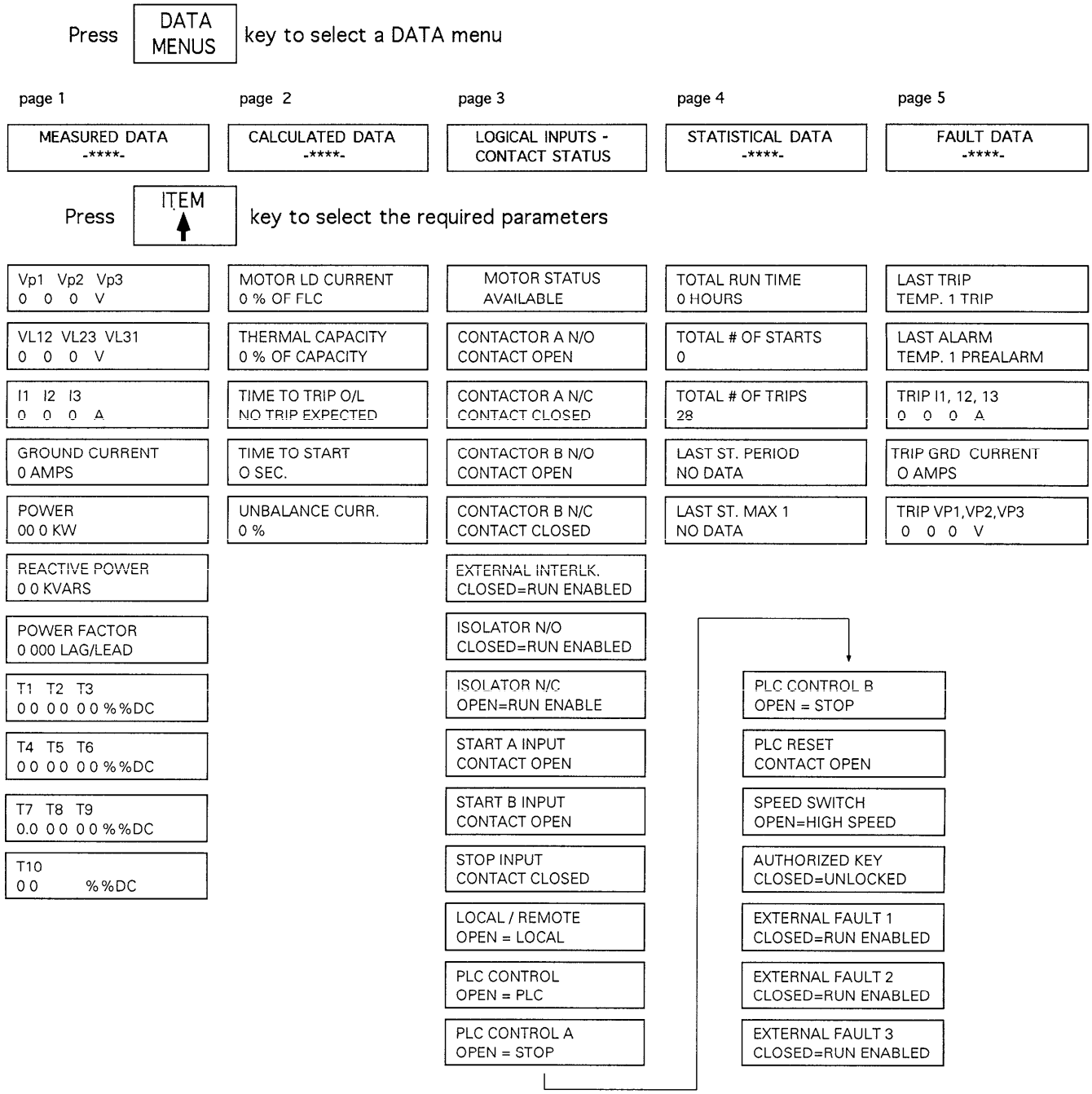



*Figure 3–2. Sequence of menu items for each category of the Data menu.*

| Display Item | Description |
|---|---|
| VP1 VP2 VP3 | Measured phase–neutral voltages. |
| VL12 VL23 VL31 | Measured line–line voltages. |
| I1 I2 I3 | Measured motor line currents. |
| GROUND CURRENT | Measured ground current. |
| POWER | Active power in kW. |
| REACTIVE POWER | Reactive power in kVARs. |
| POWER FACTOR | Leading or lagging power factor. |
| T1 T2 T3 | RTD 1–3 temperatures in °C. |
| T4 T5 T6 | RTD 4–6 temperatures in °C. |
| T7 T8 T9 | RTD 7–9 temperatures in °C. |
| T10 | RTD 10 temperature in °C. |

*Table 3–1. Menu items available in the Measured Data category.*

| Display Item | Description |
|---|---|
| MOTOR LOAD CURRENT | Motor current as a percentage of MOTOR FLC. |
| THERMAL CAPACITY | Thermal capacity register value. |
| TIME TO TRIP O/L | Time to trip when the motor current is above overload pickup. The actual time depends on the overload, $t_6$x, and HOT/COLD ratio settings. |
| TIME TO START | Expected time to start.<br>After an OVERLOAD trip, the expected time for the thermal capacity to decrease to 50% of maximum allowed. The actual time depends on the cool time factor.<br>After TOO MANY STARTS trip, the maximum value of TIME TO START equals START INHIBIT time. |
| UNBALANCED CURRENT | Difference between the max. and min. of the three motor line currents, related to the larger of the max. line current and MOTOR FLC. |

*Table 3–2. Menu items available in the Calculated Data category.*

| Display Item | Description |
|---|---|
| MOTOR STATUS | Displays the status of the motor:<br>Not Available<br>Available<br>Starting<br>Running |
| CONTACTOR A N/O<br>CONTACTOR A N/C | Contactor A status: N/C at terminals 13 & 36<br>N/O at terminals 14 & 37<br>Displays position of auxiliary input contacts (open or closed).<br>Special cases:<br>CONTROL CIRCUIT OPEN – contacts don't close after DMP START command.<br>WELDED CONTACTS – contacts don't open after a DMP STOP command.<br>HARD WIRED START – N/O contacts close with no DMP command.<br>HARD WIRED STOP – N/C contacts open with no DMP command.<br>To verify contactor status according to DMP commands, both N/C and N/O contacts must be connected. |
| CONTACTOR B N/O<br>CONTACTOR B N/C | Contactor B status: N/O at terminals 39 & 16<br>N/C at terminals 38 & 15<br>Used in similar manner as above for Contactor A. |
| EXTERNL INTERLOCK | External Interlock status: terminals 33 & 10 (N/O)<br>Input is OPEN to prevent operation, closed to enable operation. If interlocking is not used, input should be closed. |
| ISOLATOR N/O<br>ISOLATOR N/C | Isolator status: N/O at terminals 41 & 18<br>N/C at terminals 40 & 17<br>Displays position of contacts of auxiliary isolator switch.<br>Open (prevents contactor operation) when N/C contacts are closed and N/O contacts are open.<br>Closed (enables a START command) when N/C contacts are open and N/O contacts are closed. |
| START A INPUT | Start A Input status: terminals 24 & 1 (N/O)<br>Used to initiate a START command when the starting method is high-speed, forward, star, or direct-on-line. Input receives a START command when the contacts close. The input can be maintained or momentary. |
| START B INPUT | Start B Input status: terminals 25 & 2 (N/O)<br>Used to initiate a START command when the starting method is low-speed, reverse, or delta. Input receives a START command when the contacts close. The input can be maintained or momentary. |
| STOP INPUT | Stop Input status: terminals 26 & 3<br>Input is N/C and receives a STOP command when the contacts open. A STOP command is always accepted. Open Stop terminals prevent a remote PLC or serial link start. The input can be maintained or momentary. |
| LOCAL/REMOTE | Local/Remote status: terminals 27 & 4<br>Input OPEN: Local control to start the motor with Contactors A and B, front panel RESET enabled.<br>Input CLOSED: Remote control to start the motor via PLC or the serial port. |
| PLC CONTROL/<br>SERIAL CONTROL | PLC/Serial control status: terminals 28 & 5<br>Input OPEN: PLC inputs accept commands.<br>Input CLOSED: Serial port accepts commands. |

*Table 3–3. Menu items available in the Logical Inputs and Contact Status category.*

| Display Item | Description |
|---|---|
| PLC CONTROL A | PLC Control A status: terminals 30 & 7 (N/O)<br>Used to control Contactor A with a PLC<br>Input OPEN: stops the motor.<br>Input CLOSED: operates Contactor A to start the motor. |
| PLC CONTROL B | PLC Control B status: terminals 31 & 8 (N/O)<br>Used to control Contactor B with a PLC<br>Input OPEN: stops the motor.<br>Input CLOSED: operates Contactor B to start the motor. |
| PLC RESET | PLC Reset status: terminals 29 & 6<br>Input is N/O; CLOSED to reset a fault from a PLC.<br>Input not accepted if PLC START command exists. |
| SPEED SWITCH | Speed Switch status: terminals 32 & 9<br>Input OPEN: motor turning at high speed.<br>Input CLOSED: motor turning at low speed.<br>Input should be OPEN if Speed Switch is not used. |
| AUTHORIZED KEY | Authorized Key status: terminals 34 & 11 (N/O)<br>Input CLOSED: enables<br>Setting changes.<br>Thermal Capacity reset.<br>Run self-test.<br>Store default settings.<br>Reset and store statistical data<br>Input OPEN: prevents above actions. |
| EXTERNAL FAULT 1 | External Fault 1 status: terminals 35 & 12 (N/C)<br>Input OPEN: alarm or trip as selected in alarm & trip options.<br>Input CLOSED: run enable.<br>If input is unused, disable External Fault 1. |
| EXTERNAL FAULT 2 | External Fault 2 status: terminals 42 & 19 (N/C)<br>Input OPEN: alarm or trip as selected in alarm & trip options.<br>Input CLOSED: run enable.<br>If input is unused, disable External Fault 2. |
| EXTERNAL FAULT 3 | External Fault 3 status: terminals 43 & 20 (N/C)<br>Input OPEN: alarm or trip as selected in alarm & trip options.<br>Input CLOSED: run enable.<br>If input is unused, disable External Fault 3. |

*Table 3–3. Menu items available in the Logical Inputs and Contact Status category (cont.).*

| Display Item | Description |
|---|---|
| TOTAL RUN TIME | Total run time since last reset of statistical data. |
| TOTAL # OF STARTS | Total number of starts since last reset of statistical data. |
| TOTAL # OF TRIPS | Total number of trips since last reset of statistical data. |
| LAST START PERIOD | Last start time duration. The time measured between a START command and when the current drops below 115% of $I_{FL}$. |
| LAST START MAX I | The maximum current of the three phases at the last start. |

*Table 3–4. Menu items available in the Statistical Data category.*

| Display Item | Description |
|---|---|
| LAST TRIP | The last active trip. Example: GND FAULT LVL 2 TRIP |
| LAST ALARM | The last active alarm. Example: EXTERNAL FAULT 1 ALARM |
| TRIP I1, I2, I3 | Phase–phase current values at the last trip. |
| TRIP GND CURRENT | Ground current at the last trip. |
| TRIP VP1, VP2, VP3 | Phase voltages at the last trip. |

*Table 3–5. Menu items available in the Fault Data category.*

### Settings Menu

The categories available in the Settings Menu are Communications, System Parameters, Voltage, Current, Power, Temperature, and Trip and Alarm Options. The range of settings and default values for each item are described in *Chapter 4 – Settings and Configurations.*

### Test and Maintenance Menu

The sequence of key presses and menu items available under the Test and Maintenance menu is illustrated in Figure 3–3. The individual menu items are described in Table 3–6.

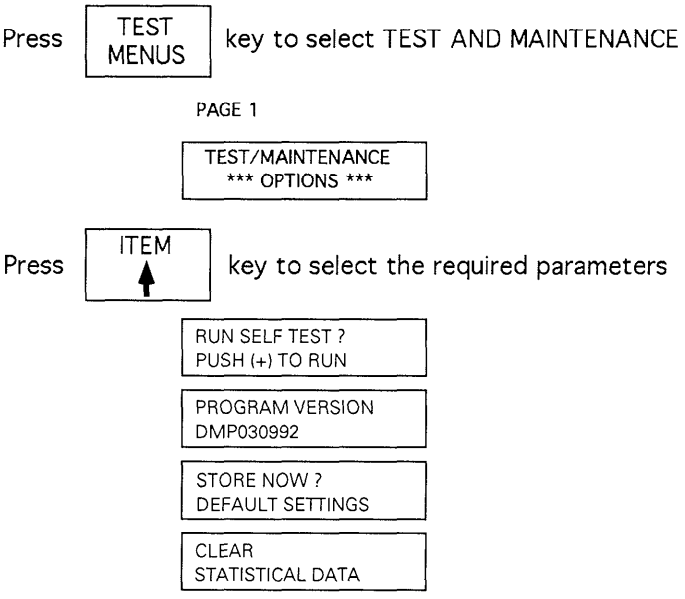



*Figure 3–3. Sequence of menu items for each category of the Test and Maintenance menu.*

| Display Item | Description |
|---|---|
| RUN SELF TEST | Press the VALUE ↑ key to run the built-in self-test. |
| PROGRAM VERSION | Displays the DMP program version in MM/DD/YY format. |
| STORE DEFAULT SETTINGS NOW? | Press the STORE and SET DATA keys simultaneously to store all default settings. |
| CLEAR STATISTICAL DATA | Press the DATA MENU and STATISTICAL DATA RESET keys simultaneously to reset Statistical Data and Fault Data to zero. |

*Table 3–6. Menu items available under the Test menu.*

### User Interface Examples

This section contains examples of using the key pad to view data and change DMP configuration settings.

#### Viewing Data

This example describes how to display the thermal capacity.

1. Press the DATA MENUS key to scroll through the Data menu until

   CALCULATED DATA

   appears on the display.
2. Press the ITEM ↑ or ITEM ↓ key to scroll through the calculated data items until

```
THERMAL  CAPACITY
XX%  OF  CAPACITY
```

appears on the display.

### Changing a Parameter Setting

This example describes how to change the value of a DMP voltage setting.

1. Press the SET MENUS key to scroll through the Settings menu until

   ```
   VOLTAGE  SETTINGS
   ```

   appears on the display.

2. Press the ITEM ↑ or ITEM ↓ key to scroll through the voltage settings until

   ```
   O/U  LEVEL  1
   115%  OF  Vn
   ```

   appears on the display.

3. Press the VALUE ↓ key until the setting changes to

   ```
   O/U  LEVEL  1
   105%  OF  Vn
   ```

4. Press the STORE key to save the new setting. The display then momentarily contains

   ```
   DATA  STORED  OK
   ```

   to verify the change.

*NOTE:* Be sure to press STORE after changing a setting and before continuing to a different menu, otherwise the change will not be retained.

*NOTE:* Assurez-vous d'appuyer sur STORE après un changement de réglage et avant de continuer dans un menu différent, sinon le changement ne sera pas mémorisé.

### Flash Messages

Flash messages are notifications that appear on the display for one second, in response to an operator action, after which the display returns to the previous message. Flash messages either confirm an activation of the requested operation or indicate the reason why it was not completed.

The list of available flash messages and their meanings appears in Table 3–7.

### Constant Messages

Constant messages are notifications because of a problem requiring operator attention. The list of available constant messages and their meanings appears in Table 3–8.

## 3–3 External Connections

This sections contains descriptions of the input and output connections made on the rear of the DMP case. Figure 1–1 shows all the available inputs and outputs in a typical external connection configuration.

### Control Power

Connect the control power source to terminals C20 (+) and C10 (–). The control power inputs accept up to #10 AWG wire. The DMP must be grounded before power is applied.

The DMP can be ordered to operate with any of three different supply voltages: 24–48 Vdc, 125–250 Vdc, and 110 or 120 Vac (selected by a rear-panel switch). Check the DMP name plate to ensure that the proper voltage is applied. The DMP has an internal 0.5 A fuse to protect the control power supply.

The DMP will remember motor information if control power is lost. Statistical, Calculated, and Fault data and Settings are stored in nonvolatile memory and are not affected by loss of power.

### Chassis Ground

The ground stud on the rear of the DMP case is connected to the RTD shields, the RS–485 shield, and the DMP chassis. Connect the ground stud to system ground with #12 AWG wire before connecting control power or attempting to operate the DMP.

| Display Item | Description |
|---|---|
| DATA SAVED OK | Displayed after a new setting is successfully saved following a STORE key press. |
| STORAGE ERROR | The new setting was not successfully stored. |
| DMP CHECK SUM ERROR | Displayed after power up if the nonvolatile memory parameter check sum does not match the previous value. |
| UNAUTHORIZED ACCESS | A parameter change, store, or reset was attempted when the authorized key was open. |
| RESET THERMAL CAPACITY?? | Indicates that a second press within 1 second will reset the thermal capacity to zero. |
| THERMAL CAPACITY RESET PERFORMED | Displayed after a successful reset of the thermal capacity. |
| UNABLE TO START TRIP | The motor could not be started after a local start because a trip was activated. |
| UNABLE TO START EXTERNL INTERLOCK | The motor could not be started after a local start because the external interlock is open. |
| UNABLE TO START ISOLATOR INPUTS | The motor could not be started after a local start because is open. |
| UNABLE TO START U/V STRT PREVENT | The motor could not be started after a local start because the actual voltage is less than the U/V STRT PREVENT setting. |
| UNABLE TO START LOCAL/REMOTE | The motor could not be started after a local start because the Local/Remote input is closed (set for Remote start). |
| UNABLE TO START CHECK SYSTEM | The motor could not be started after a local start; check the system. |
| SELF TEST PASSED | The DMP self-test passed. |
| SELF TEST FAILED | The DMP self-test failed. |

*Table 3–7. Flash messages appearing in response to an operator action.*

| Display Item | Description |
|---|---|
| HARD WIRED STOP | Displayed when the contactor is suddenly de-energized without a DMP command to do so. |
| HARD WIRED START | Displayed when the contactor is suddenly energized without a DMP command to do so. |
| ALARM | Displayed when an alarm condition has occurred. The second display line indicates the type of alarm. |
| TRIP | Displayed when a trip condition has occurred. The second display line indicates the type of trip. |

*Table 3–8. Constant messages indicating a need for operator action.*

## Current Inputs

The DMP has inputs for three or four external CTs, connected as shown in Figure 1–2. Each phase consists of a 1 A (nominal) input, a 5 A (nominal) tap, and common. The terminals accept up to #10 AWG wire. See Table 2–1 for the maximum permissible short-term current levels.

## Voltage Inputs

The DMP has three phase-voltage inputs and a neutral terminal for connection to three- or four-wire systems. The voltage inputs can be connected to external VTs in four ways: open delta, delta, wye, and single VT, as shown in Figure 1–2.

## Output Contacts

The DMP contains four output relays, each having one N/C and one N/O contact. All contacts are rated at 8 A, 250 Vac resistive, and 1800 VA inductive. The contacts are accessible through a disconnectable connector on the rear of the DMP. See Table 2–2 for the contact technical specifications.

### Relay A

Relay A controls contactor A and is automatically configured according to the starting method selected (Settings Menu – System Parameters). Contactor A can be used in the following starting configurations:

- Direct on-line starting (full-voltage start).
- Star period of star/delta starting.
- Forward of a forward/reverse motor.
- High speed of a two-speed motor.

When the relay is closed, front-panel LED A is lit. Relay A's N/O contacts are available at terminals 44 and 46, the N/C contacts at terminals 44 and 45.

### Relay B

Relay B controls contactor B and is automatically configured according to the starting method selected (Settings Menu – System Parameters). Contactor B can be used in the following starting configurations:

- Delta period of star/delta starting.
- Reverse of a forward/reverse motor.
- Low speed of a two-speed motor.

When the relay is closed, front-panel LED B is lit. Relay B's N/O contacts are available at terminals 47 and 49, the N/C contacts at terminals 47 and 48.

### Relay C

Relay C functions as an auxiliary relay that can be configured as one of the following (Settings Menu – System Parameters):

- Alarm relay with fail-safe logic.
- Slave relay for Contactor A.
- Slave relay for Contactor B.
- Start/Run – controls the line contactor in star/delta starters.

Relay C is not automatically configured. When the relay is closed, the front-panel ALARM LED is lit. Relay C's N/O contacts are available at terminals 50 and 52, the N/C contacts at terminals 50 and 51.

If Relay C is enabled to alarm, the relay contacts are reset after an alarm only when the alarm condition reverts to normal and a Panel or PLC RESET is sent. Panel RESET and PLC RESET are enabled in the Settings Menu – Tripping and Alarm.

### Relay D

Relay D functions as an auxiliary relay that can be configured as one of the following (Settings Menu – System Parameters):

- Trip relay.
- Trip relay with fail-safe logic.
- Slave relay for Contactor A.
- Slave relay for Contactor B.

Relay D is not automatically configured. When the relay is closed, the front-panel TRIP LED is lit. Relay D's N/O contacts are available at terminals 53 and 55, the N/C contacts at terminals 53 and 54.

If Relay D is enabled to trip, the relay contacts are reset after a trip only when the trip condition reverts to normal and a Panel or PLC RESET is sent. Panel RESET and PLC RESET are enabled at the Settings Menu – Tripping and Alarm.

## Logic Control Inputs

The DMP has 20 logic inputs internally connected to control power. The maximum permissible resistance across these terminals is 3 kΩ. Long leads should be twisted to reduce noise and common-mode voltages.

The logic inputs communicate information to the DMP through switches, relay contacts, or application of control voltage. Since the inputs are connected to control voltage, the DMP can also receive an input from another power source with the same rating as the DMP's power source. With ac control power, the input must be connected to the same phase.

### RTD Inputs

The DMP has 10 RTD inputs, each of which can accept a 10 Ω copper or 100 Ω platinum/120 Ω nickel RTD, depending on the DMP model (see the Getting Started page for the appropriate catalog number). An RTD must be connected to the DMP with a shielded three-wire cable whose resistance is no more than 25% of the RTD resistance. All RTD cable shields must be connected to the rear-panel ground studs. All RTD temperatures may be viewed on the front-panel display.

### Communication Port

Communications through the rear-panel RS–485 port can perform the following:

- Read actual input parameters.
- Read all parameter settings.
- Modify all parameter settings except communications.
- Control the DMP/Motor (START, STOP).
- Reset a fault.

A serial link RESET is always enabled, unlike a Panel RESET or PLC RESET. Thermal Capacity can only be reset from the front panel.

A shielded, twisted-pair cable must be used to connect the DMP to the communication system. Connect the shield to the rear-panel ground stud.

*CAUTION* Ensure that the DMP is connected to system ground before using the communication port.

*ATTENTION:* Assurez-vous que le DMP est branché au système de mise à la terre avant d'utiliser les ports de communication.

## 4–1 Introduction

This chapter describes the DMP system parameters that are set in the various categories of the Settings Menu. Default settings are the values set at the factory. For any given application, these settings may not provide adequate protection. It is the customer's responsibility to determine the appropriate settings for each of these parameters.

The default settings are stored in nonvolatile memory in the DMP and are always available. The default settings can be restored at any time from the Test/Maintenance Options menu, as described in *Chapter 3 – System Interfaces.*

***CAUTION:*** Enabling the default settings will result in loss of all settings in effect before this action. This may result in inadequate motor protection.

***ATTENTION:*** Si vous utilisez les réglages préajustés, vous perdrez tous les réglages établis auparavant. Une protection inadéquate du moteur peut en résulter.

Each of the parameters is described below, grouped by menu category. Each section contains a table listing the range of values for each parameter and the default setting.

All settings required by DMP systems with dc power supplies are set in software through the user interface. DMP systems with ac power supplies have a switch that can be set to either 120 or 240 Vac, as appropriate. See *Chapter 2 – Hardware Description and Specifications*

Appendix 1 contains blank settings forms that may be copied and used to record the settings for a particular application.

Figure 4–1 shows the sequence of key presses to access each of the menu items under each category of the Settings menu.

## 4–2 Communication Settings

This section contains descriptions of the parameters set with the Communication category of the Settings menu. Table 4–1 lists the ranges of available values and the default settings.

1. MOTOR NUMBER – This setting can be used for convenience to identify the motor and has no effect on DMP operation.
2. BAUD RATE – This setting establishes the baud rate (bits per second) of the DMP system's RS–485 serial port and must match the baud rate of the modem or serial device connected to the port. This setting can only be changed with the front-panel keypad. The DMP must be reinitialized by switching the power supply off and on for the new baud rate to be effective.
3. ADDRESS NO – This setting establishes the DMP's address on the RS–485 serial link. A maximum of 32 DMP systems are allowed on a serial link. Setting the value to 33 disables communications with the DMP. The host computer typically has address 0 on the serial link.

4–6. FUTURE ENH 1, 2, 3 – These settings are reserved for future enhancements to the DMP system communication capabilities. These should all be set to NOT USED.

| Item | Parameter | Settings Range | Default |
|---|---|---|---|
| 1 | MOTOR NUMBER | 0–320 | 0 |
| 2 | BAUD RATE | 110, 300, 1200, 2400, 4800, 9600 | 9600 |
| 3 | ADDRESS NO | 1–33 | 33 |
| 4 | FUTURE ENH 1 | USED, NOT USED | NOT USED |
| 5 | FUTURE ENH 2 | USED, NOT USED | NOT USED |
| 5 | FUTURE ENH 3 | USED, NOT USED | NOT USED |

*Table 4–1. Settings available in the Communication category.*

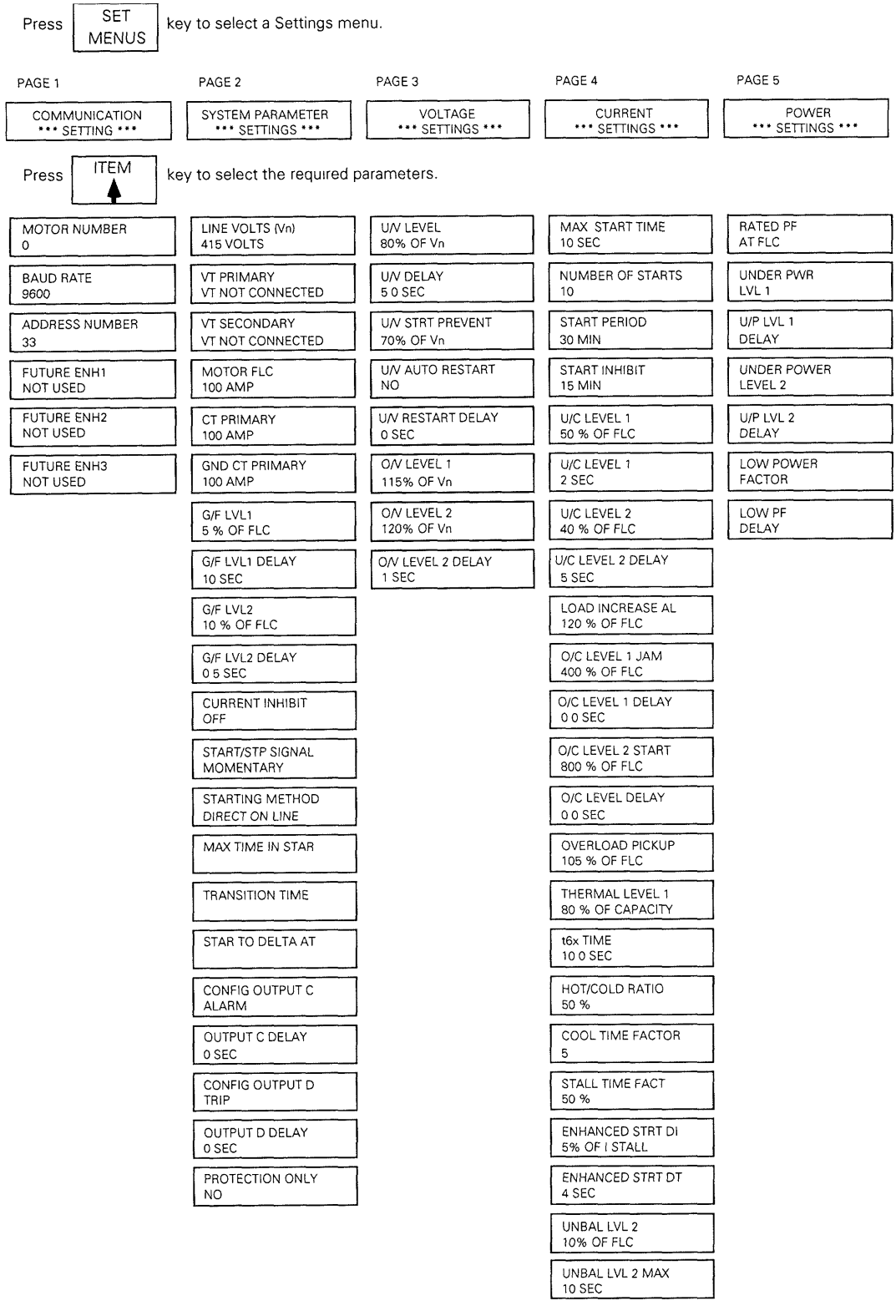



*Figure 4–1. Sequence of menu items for each category of the Settings menu.*

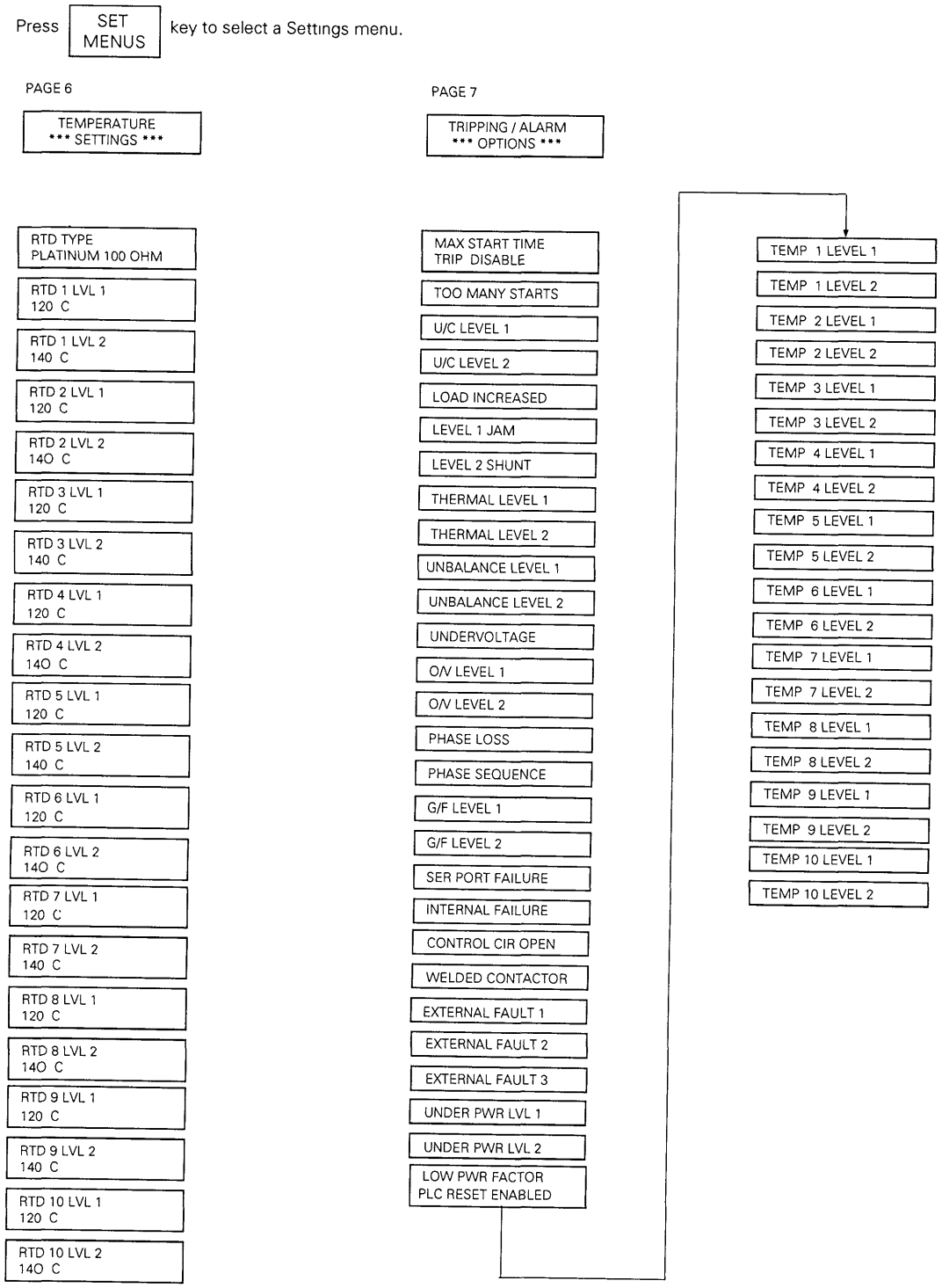



*Figure 4–1. Sequence of menu items for each category of the Settings menu (cont).*

## 4–3 System Parameter Settings

This section contains descriptions of the parameters set with the System Parameter category of the Settings menu. Table 4–3 lists the ranges of available values and the default settings.

1. LINE VOLTS (Vn) – Set this parameter to the nominal line-to-line (primary) system voltage.
2. LINE FREQUENCY – Set to the nominal system frequency.
3. VT PRIMARY – For delta-, open delta-, or single line-to-line-connected VTs, set to the rated voltage of the primary windings. Table 4–2 contains the setting criteria for wye- or single line-to-ground-connected VTs. Set to NOT CONNECTED if VTs are not used.
4. VT SECONDARY – For delta or open delta connected VTs, set to the rated voltage of the secondary windings. Table 4–2 contains the setting criteria for single-phase or wye-connected VTs. Set to NOT CONNECTED if VTs are not used.
5. MOTOR FLC – This item should be set to the full-load current on the motor name plate. For STARTING METHOD of TWO SPEED, set to the full-load current corresponding to HIGH speed operation.
6. CT PRIMARY – Set to the rated primary current of the CTs used in each phase. The CT secondary rating of 1 A or 5 A has no effect on this setting.
7. GND CT PRIMARY – Set to the rated primary current of the CT used for ground (earth) fault protection. If residual CT connections are used, this setting is the same as CT PRIMARY.
8. GND FAULT LVL 1 – This level of ground-fault protection is primarily intended as an alarm and is usually set lower than GND FAULT LVL 2. The transient overreach due to dc offset is under 1% and can be disregarded in setting the pickup value. See the CURRENT INHIBIT setting described below for possible blocking of this function at very high fault currents.
9. G/F LVL 1 DELAY – Set to the time delay desired for ground-fault level 1.
10. GND FAULT LVL 2 – This level of ground-fault protection is primarily intended as a trip and is usually set higher than GND FAULT LVL 1, but is otherwise identical.
11. G/F LVL 2 DELAY – Set to the time delay desired for ground-fault level 2.
12. CURRENT INHIBIT – If a motor contactor is not rated adequately for the available short circuit current, this setting can be used to block the operation of Relays A, B, and D to prevent damage to the contactor.

***CAUTION:*** If this feature is used, well-coordinated backup protection must be provided at the upstream fuse or breaker to avoid damage to the contactor and motor.

***ATTENTION:*** Si cette option est utilisée, une protection d'appoint bien coordonnée doit être fournie au fusible d'amont ou au disjoncteur afin d'éviter des dommages au contacteur et au moteur.

| *VT Connection* | *VT Primary* | *VT Secondary* |
|---|---|---|
| Single VT, L–L connected | Rated voltage of primary windings | 1.73 times rated voltage of secondary windings |
| Single VT, L–G connected | Rated voltage of primary windings (1) | Rated voltage of secondary windings (1) |
| 3 VTs, Wye-connected | Rated voltage of primary windings (1) | Rated voltage of secondary windings (1) |

1. For line-to-ground connected VTs (three-phase or single-phase), set both VT PRIMARY and VT SECONDARY to 1.73 times the respective winding rated voltage if the rated secondary voltage is less than 95 Vac.

*Table 4–2. Criteria for setting VT PRIMARY and VT SECONDARY in single- and wye-connected VT applications.*

| Item | Parameter | Settings Range | Step Size | Default |
|---|---|---|---|---|
| 1 | LINE VOLTS (Vn) | 100V–22kV | 5 V up to 1 kV, 100 V above 1 kV | 480 V |
| 2 | LINE FREQUENCY | 50, 60 Hz | — | 60 Hz |
| 3 | VT PRIMARY | 100V–22kV; NOT CONNECTED | 10 V up to 1 kV, 100 V above 1 kV | NOT CONNECTED |
| 4 | VT SECONDARY | 95V–660V; NOT CONNECTED | 5V | NOT CONNECTED |
| 5 | MOTOR FLC | 1–2000 A | 1 A up to 100 A, 5 A above 100 A | 100 A |
| 6 | CT PRIMARY | 1–2000 A | 1 A up to 100 A, 5 A above 100 A | 100 A |
| 7 | GND CT PRIMARY | 1–2000 A | 1 A up to 100 A, 5 A above 100 A | 100 A |
| 8 | GND FAULT LVL 1 | 1–100% of MOTOR FLC | 1% | 5% |
| 9 | G/F LVL 1 DELAY | 1–60 s | 1 s | 10 s |
| 10 | GND FAULT LVL 2 | 1–100% of MOTOR FLC | 1% | 10% |
| 11 | G/F LVL 2 DELAY | 0.0–2.0 s | 0.1 s | 0.5 s |
| 12 | CURRENT INHIBIT | 400–1000% of MOTOR FLC; OFF | 10% | OFF |
| 13 | START/STP SIGNAL (1) | MOMENTARY, MAINTAINED | — | MOMENTARY |
| 14 | STARTING METHOD (1) | DIRECT ON LINE, STAR (WYE),/DELTA, REVERSING, TWO SPEED | — | DIRECT ON LINE |
| 15A | MAX TIME IN STAR (1, 2) | 1–60 s | 1 s | 10 s |
| 15B | TRANSITION TIME (1, 2) | 50–2000 ms | 50 ms | 200 ms |
| 15C | STAR TO DELTA AT (1, 2) | 70–200% of MOTOR FLC | 5% | 150% |
| 16A | LOW SPEED FLC (1, 3) | 1–2000 A | 1 A up to 100 A, 5 A above 100 A | 10 A |
| 16B | LOW SPD t6x TIME (1, 3) | 0.5–120 s | 0.5 s | 10 s |
| 17 | CONFIG OUTPUT C | ALARM, CONTACTOR A, CONTACTOR B, START/RUN | — | ALARM |
| 18 | OUTPUT C DELAY | 0–120 SEC | 1 s | 0 SEC |
| 19 | CONFIG OUTPUT D | TRIP, TRIP–FAIL SAFE, CONTACTOR A, CONTACTOR B | — | TRIP |
| 20 | OUTPUT D DELAY | 0–120 SEC | 1 s | 0 SEC |
| 21 | PROTECTION ONLY | YES, NO | — | NO |

1. Settings identified are applicable only if PROTECTION ONLY is set to NO.
2. Settings identified are applicable only if STARTING METHOD is set to STAR(WYE)/DELTA.
3. Settings identified are applicable only if STARTING METHOD is set to TWO SPEED.

*Table 4–3. Settings available in the System Parameter category.*

To minimize damage to the motor in the event that the backup protection fails, the DMP will allow operation of output relays A, B, and D on the thermal overload function. For proper coordination, the upstream backup protection must be faster than the DMP thermal overload function at all currents above the CURRENT INHIBIT setting. Except for special circumstances, this parameter should be set to OFF.

13. START/STP SIGNAL – If PROTECTION ONLY is set to NO, set this parameter to describe the local start and stop contact inputs (terminals 1, 2, and 3).

**14.** STARTING METHOD – If PROTECTION ONLY is set to NO, set this parameter to the motor starting method. Note that output relays A and B are configured automatically based on this setting and that output relay C can be configured as a START/RUN contactor for the STAR(WYE)/DELTA starting method. Refer to *Chapter 1 – Product Description* for details of automatic configuration and to CONFIG OUTPUT C below.

**15A.** MAX TIME IN STAR – Set to the maximum time that output relay A (Star contactor control) can be energized during the Star/Delta starting sequence. The actual time in Star is automatically shortened if the starting current drops below the STAR TO DELTA AT setting within the maximum time window. Note that the DMP system design sets the minimum time in star to 25% of MAX TIME IN STAR.

**15B.** TRANSITION TIME – A transition time during which both Star and Delta contactors are de-energized is required for a successful Star/Delta starting sequence. To provide an adequate margin, set to a time longer than the maximum dropout time of the Star contactor.

**15C.** STAR TO DELTA AT – Set to the current level at which the Star period can end during the START sequence. This parameter can be used to shorten automatically the overall starting time of the motor. Note that the Star period will end at MAX TIME IN STAR even if the motor current is higher than STAR TO DELTA AT.

**16A.** LOW SPEED FLC – Set equal to the name plate full-load current in terms of primary amperes for low-speed operation.

**16B** LOW SPEED t6x TIME – This parameter determines which thermal overload protection curve is used in low-speed operation. It specifies the THERMAL LEVEL 2 operating time at six times the LOW SPEED FLC (with the motor at ambient temperature). Figures 4–2 and 4–3 contain the thermal overload characteristic curves for a cold and hot motor, respectively.

**17.** CONFIG OUTPUT C – Set to the desired configuration for output relay C:

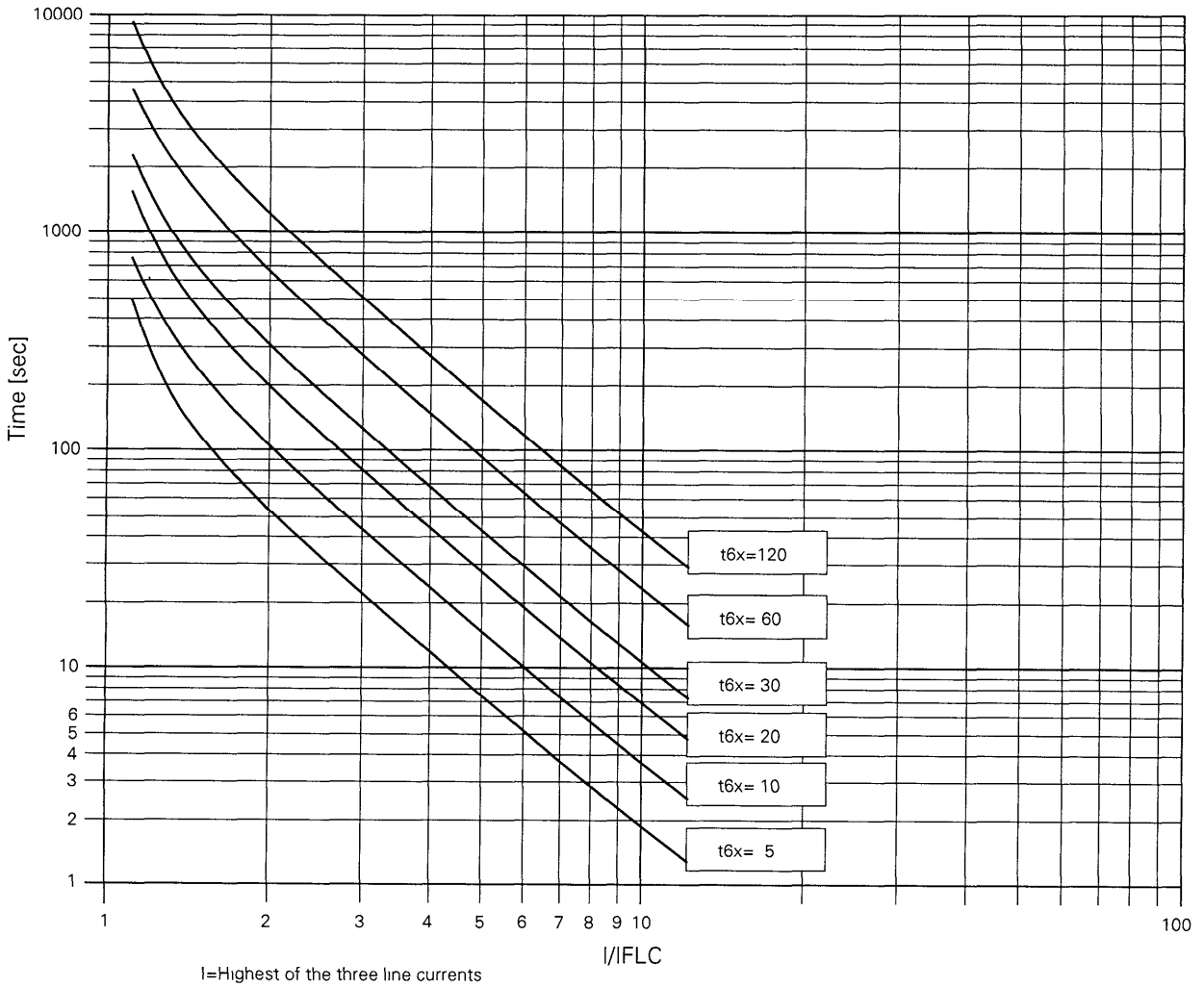
- ALARM: The output relay is picked up normally and drops out on any alarm condition, with an adjustable time delay, or on loss of DMP control power. See *Section 4–8 Tripping and Alarm Options* for configuring the alarm conditions.
- CONTACTOR A: Configures output relay C to operate with output relay A (contactor A control), but with an adjustable time delay.
- CONTACTOR B: Configures output relay C to operate with output relay B (contactor B control), but with an adjustable time delay.
- START/RUN: When used with the Star/Delta starting method, this configuration can be used to control the main contactor with output relay C. The relay is energized on a successful START command and stays energized through the motor START and RUN modes.

**18.** OUTPUT C DELAY – Set to the desired time delay for output relay C. The setting should be 0 second unless a specific application requires it otherwise.

**19.** CONFIG OUTPUT D – Set to the desired configuration for output relay D.

- TRIP: The output relay is normally dropped out and picks up on any trip condition. See *Section 4–8 Tripping and Alarm Options* for configuring the trip conditions.
- TRIP–FAIL SAFE: Similar to the TRIP option with the addition of fail-safe operation. The output relay is normally energized and drops out on any trip condition or on loss of control power to the DMP. See *Section 4–8 Tripping and Alarm Options* for configuring the trip conditions.
- CONTACTOR A: Configures output relay D to operate with output relay A (contactor A control), but with an adjustable time delay.
- CONTACTOR B: Configures output relay D to operate with output relay B (contactor B control), but with an adjustable time delay.

**20.** OUTPUT D DELAY – Set to the desired time delay for output relay D, if it is configured as CONTACTOR A or B. This setting adds no delay if output relay D is configured as TRIP or TRIP–FAIL SAFE.



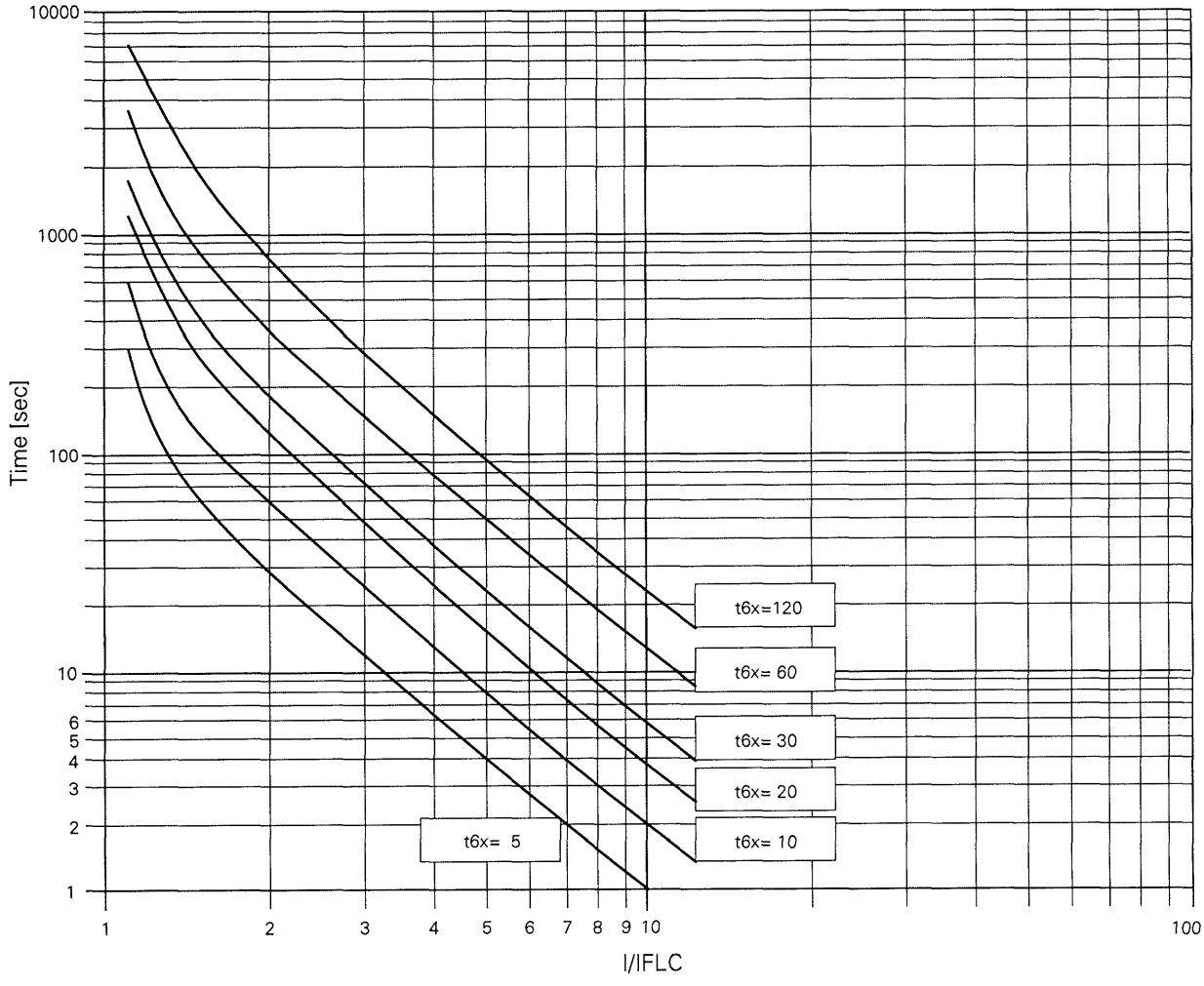

I=Highest of the three line currents
IFLC=Motor full-load current
Note. for overload pickup (OLPU) other than 105%, the X-axis represents [(I/IFLC)(105/OLPU)]

*Figure 4–2. Thermal overload protection characteristic curves for a cold motor and overload pickup of 105%.*

**21.** PROTECTION ONLY – Set this function to NO if the DMP is used for motor control as well as protection.

If the DMP is used for motor protection only, then this function can be set to YES. If PROTECTION ONLY is set to YES, then the following conditions also apply:

- All the contact inputs listed in Table 1–3 will be ignored, except for the following:
  - Authorized key-switch input.
  - Speed-switch input.
  - Three external protective device inputs.
- All control functions will be disabled, including Start, Auto Start, Stop, output relays A and B, and LEDs A and B.
- The DMP will consider the motor to be in STOP mode whenever the motor current is less than 12% of the MOTOR FLC or when it produces a TRIP output. Note that the no-load current of a synchronous motor depends on its field current and should be adjusted so that the no-load current is at least 12%.
- With the motor is in STOP mode, the DMP will go to START mode when the motor current rises above (OVERLOAD PICKUP + 10%) of




I=Highest of the three line currents
IFLC=Motor full-load current

Note. for overload pickup (OLPU) other than 105%, the X-axis represents [(I/IFLC)(105/OLPU)]

*Figure 4–3. Thermal overload protection characteristic curves for a hot motor and overload pickup of 105%.*

MOTOR FLC. Once in START mode, the DMP will go to RUN mode when the motor start current drops below the same threshold.

***NOTE:*** When PROTECTION ONLY is set to YES, the DMP must be in START mode before it can go to RUN mode.

***NOTE:*** Lorsque PROTECTION ONLY est réglé sur YES, le DMP doit être sur le mode START avant qu'il puisse aller au mode RUN.

## 4–4 Voltage Settings

This section contains descriptions of the parameters set with the Voltage category of the Settings menu. Table 4–4 lists the ranges of available values and the default settings.

1. U/V LEVEL – This function sets the threshold for undervoltage protection. It is active only when the motor is in START or RUN mode. The DMP computes an average of the three line-to-line voltages and compares it with the threshold set for this function.

   Undervoltage protection can be used with either single- or three- phase VT inputs. VT connections are described in *Chapter 1 – Product Description*. If no voltage input is connected to the DMP, both the trip and alarm options of this function must be disabled. See *Section 4–8 Tripping and Alarm Options* for configuring these options.

2. U/V DELAY – This function sets a definite time delay to undervoltage protection operation. This delay can be used to prevent nuisance operations during normal dips in the motor supply voltage.

3. U/V START PREVENT – This function establishes the minimum voltage at the motor bus before the DMP will allow the motor to be started. If no voltage signal is connected to the DMP, this setting must be OFF.

4. U/V AUTO RESTART – This function is applicable only when START/STP SIGNAL (described in *4–3 System Parameter Settings*) is set to MOMENTARY and an ac auxiliary power supply is used. It should be set to DISABLE unless both of these conditions are met.

   When this function is set to ENABLE, the DMP automatically restarts the motor following a momentary outage of the auxiliary power supply, as follows:
   - Immediate restart if the outage duration is less than 0.2 second.
   - Delayed restart (according to U/V RESTRT DELAY) if the outage duration is between 0.2 and 4.0 seconds.
   - No restart if the outage lasts longer than 4.0 seconds.

5. U/V RESTRT DELAY – Sets the time delay before a restart following an outage of the auxiliary power supply lasting between 0.2 and 4.0 seconds. This delay can be used to stagger restarting of multiple motors after a momentary disturbance.

6. O/V LEVEL 1 – This level of overvoltage protection is primarily intended as an alarm and is usually set lower than O/V LEVEL 2. The time delay is factory set to 1 second.

| Item | Parameter | Settings Range | Step Size | Default |
|---|---|---|---|---|
| 1 | U/U LEVEL | 50–95% of Vn | 1% | 80% |
| 2 | U/U DELAY | 0.2–10 s | 0.1 s | 5.0 s |
| 3 | U/U SRTR PREVENT (1) | 51–95% of Vn or OFF | 1% | OFF |
| 4 | U/U AUTO RESTART (1) | DISABLE, ENABLE | — | DISABLE |
| 5 | U/U RSTRT DELAY (1) | 0.1–120 SEC | 0.1 s up to 10 s, 1 s above 10 s | 4.0 s |
| 6 | O/U LEVEL 1 | 100–120% of Vn | 1% | 115% |
| 7 | O/U LEVEL 2 | 100–120% of Vn | 1% | 120% |
| 8 | O/U LVL 2 DELAY | 1–100 SEC | 1 s | 1 s |

1. Settings identified are applicable only if PROTECTION ONLY is set to NO.

*Table 4–4. Settings available in the Voltage category.*

Overvoltage protection can be used with either single- or three-phase VT inputs. VT connections are described in *Chapter 1 – Product Description*. If no voltage input is connected to the DMP, both the trip and alarm options of this function must be disabled. See section *4–8 Tripping and Alarm Options* for configuring these options. This comment also applies to item 7.

7. O/V LEVEL 2 – This level of overvoltage protection is primarily intended as a trip, is usually set higher than O/V LEVEL 1, and has an adjustable time delay. The previous paragraph applies to this item also.

8. O/V LVL 2 DELAY – This setting provides a definite time delay for the O/V LEVEL 2 function. This delay can help prevent nuisance operations during normal momentary overvoltage conditions in the motor power supply.

## 4–5 Current Settings

This section contains descriptions of the parameters set with the Current category of the Settings menu. Table 4–5 lists the ranges of available values and the default settings.

1. MAX START TIME – The DMP counts the start time from a successful START command to the point when the motor current decreases to (OVERLOAD PICKUP + 10%) of MOTOR FLC. If the actual start time exceeds this setting, the DMP will drop out of START mode. This item should be set above the highest start time expected for this application. The actual start time (LAST START PERIOD) measured by the DMP is saved as part of the Statistical Data and can be used to verify the expected start time.

2. NUMBER OF STARTS – If the total number of starts within the STARTS PERIOD time window exceeds this setting, protection function TOO MANY STARTS operates.

3. STARTS PERIOD – This setting determines the time window during which the DMP counts the total number of starts. This is a dynamic window, always looking back from the present time.

4. START INHIBIT – Following an operation of the TOO MANY STARTS protection function, the DMP inhibits any new attempts to start the motor for a time equal to this setting. AUTO RESET of the function TOO MANY STARTS is also inhibited for the START INHIBIT period.

5. U/C LEVEL 1 – Undercurrent protection is only active when the motor is in RUN mode. This level is primarily intended for an alarm and is usually set higher than U/C LEVEL 2. Sustained undercurrent may be an indication of total or partial loss of load and may justify trip or alarm conditions in some applications.

6. U/C LVL 1 DELAY – This setting defines the time delay before U/C LEVEL 1 operates.

7. U/C LEVEL 2 – This level is primarily intended for a trip and is usually set lower than U/C LEVEL 1, but is otherwise identical.

8. U/C LVL 2 DELAY – This setting defines the time delay before U/C LEVEL 2 operates.

9. LOAD INCREASE – This function is only active when the motor is in RUN mode. It provides an operation when the average motor current exceeds the setting for more than 5 seconds.

10. O/C LEVEL 1-JAM – This function detects a jam or stall condition in a running motor. A trip or alarm is generated if the average motor current is above the setting for longer than the O/C LVL 1 DELAY.

11. O/C LVL 1 DELAY – Sets a definite time delay before jam or stall overcurrent protection operates.

12. O/C LVL 2-SHORT – This function detects a short-circuit in the motor. A trip or alarm is generated if any of the phase currents is above the setting for longer than the O/C LVL 2 DELAY. The transient overreach of this function due to a dc offset is under 1% and may be disregarded in setting the pickup value.

| Item | Parameter | Settings Range | Step Size | Default |
|---|---|---|---|---|
| 1 | MAX START TIME | 1–250 s | 1 s | 10 s |
| 2 | NUMBER OF STARTS | 1–10 | 1 | 10 |
| 3 | STARTS PERIOD | 1–60 min | 1 min | 30 min |
| 4 | START INHIBIT | 1–60 min | 1 min | 30 min |
| 5 | U/C LEVEL 1 | 10–90% of MOTOR FLC | 1% | 50% |
| 6 | U/C LVL 1 DELAY | 1–60 s | 1 s | 2 s |
| 7 | U/C LEVEL 2 | 10–90% of MOTOR FLC | 1% | 40% |
| 8 | U/C LVL 2 DELAY | 1–60 s | 1 s | 5 s |
| 9 | LOAD INCREASE | 60–150% of MOTOR FLC | 1% | 120% |
| 10 | O/C LEVEL 1-JAM | 100–500% of MOTOR FLC | 10% | 400% |
| 11 | O/C LVL 1 DELAY | 0.5–10 s | 0.5 s | 2.0 s |
| 12 | O/C LVL 2-SHORT | 400–1200% of MOTOR FLC | 10% | 800% |
| 13 | O/C LVL 2 DELAY | 0–4 s | 0.1 s | 0.5 s |
| 14 | OVERLOAD PICKUP | 60–130% of MOTOR FLC | 1% | 105% |
| 15 | THERMAL LEVEL 1 | 50–99% of THERMAL CAPACITY | 1% | 805 |
| 16 | t6x TIME | 0.5–120 s | 0.5 s | 2.0 s |
| 17 | HOT/COLD RATIO | 20–100% of THERMAL CAPACITY | 1% | 50% |
| 18 | COOL TIME FACTOR | 1–15 | 1 | 5 |
| 19 | STALL TIME FCTR | 20–100% | 1% | 50% |
| 20 | ENHANCED STRT:dI | 5–20% of stall current, OFF | 1% | 10% |
| 21 | ENHANCED STRT:dT | 4–40 s | 0.5 s | 10 s |
| 22 | UNBALANCE LVL 2 | 10–40% of MOTOR FLC | 1% | 15% |
| 23 | U/B LVL2 MAX T | 20–120 s | 1 s | 30 s |

*Table 4–5. Settings available in the Current category.*

The pickup should be set at least 5% above the highest expected start current. The actual start current (LAST START MAX I) measure by the DMP is saved as part of the Statistical Data and can be used to verify the expected starting current. See the setting information for CURRENT INHIBIT in *4–3 System Parameter Settings* for possible blocking of this function at very high fault currents.

**13.** O/C LVL 2 DELAY – Sets a definite time delay before short-circuit overcurrent protection operates. This delay is in addition to the normal operating time for this function of 40–80 ms.

Items 14–21 are interacting settings related to thermal overload protection. Based on these settings, the DMP dynamically computes the thermal condition (referred to as THERMAL CAPACITY) of the motor. The computed THERMAL CAPACITY is proportional to motor temperature. A THERMAL CAPACITY value of 100% is equivalent to the maximum allowable temperature of the motor, at which point the function THERMAL LEVEL 2 operates.

**14.** OVERLOAD PICKUP – Sets the pickup threshold for thermal overload functions. This setting should be kept at the default of 105% for motors with service factors of 1.1 to 1.15. The pickup should be at least 5% below the service factor of the motor.

**15.** THERMAL LEVEL 1 – This function is intended to generate an alarm when the THERMAL CAPACITY exceeds the setting.

**16.** t6x TIME – This setting, in conjunction with OVERLOAD PICKUP, establishes the overload characteristic curve for THERMAL LEVEL 2 protection. Figures 4–2 and 4–3 contain the families of curves for cold and hot motor conditions.

A "cold" motor is defined as at ambient temperature and has a THERMAL CAPACITY of 0%. A "hot" motor has been running at just under the overload pickup current long enough to attain a steady-state temperature. The steady-state THERMAL CAPACITY at different current levels can be determined with the following equations,

$$TC = \begin{cases} \dfrac{100 - HCR}{(I/OLPU)^2}, & I < OLPU \\ 100\,(I/OLPU)^2, & I \geq OLPU \end{cases}$$

where TC is the steady-state THERMAL CAPACITY in %, HCR is the HOT/COLD RATIO setting, I is the steady-state current in % of MOTOR FLC, and OLPU is the OVERLOAD PICKUP setting.

The overload curves in Figures 4–2 and 4–3 are based on an OVERLOAD PICKUP setting of 105% and a HOT/COLD RATIO of 50%. As shown in Figures 4–2 and 4–3, the t6x TIME setting is the operating time of THERMAL LEVEL 2 at a current equal to six times the MOTOR FLC when it is in cold condition.

17. HOT/COLD RATIO – This setting is the available thermal capacity of the motor in percentage of cold motor capability.

18. COOL TIME FACTOR – This setting is the ratio of the cooling time constant of the stopped motor to the heating/cooling time constant of the running motor. It is used to model motor cooling after a STOP condition.

19. STALL TIME FACTOR – This setting is the ratio of the heating time constant of a motor when its rotor is stopped to the heating time constant when it is rotating. This setting determines the modification of the overload curve used by the DMP during a part of the motor starting mode. The t6x TIME is reduced to (t6x TIME) X (STALL TIME FCTR)/100 until there is evidence of motor rotation.

    Either a speed switch input or the enhanced start logic (described next) can be used to detect the rotation of the motor.

    This feature can be particularly useful for motors having acceleration times that are significantly longer than their safe stall time at locked rotor, since it allows successful motor starting with realistic overload protection and without compromising the safe stall time.

20. ENHANCED STRT: dI – Described with function 21.

21. ENHANCED STRT: dT – The enhanced start function logic (patent pending) implemented in the DMP provides startup protection to a motor with no speed switch. Following a successful START command, the DMP computes a drop in current (dI) during a time window (dT). The time window is started 30 cycles after motor start current is detected to override the effect of any dc offset. The current at the start of this time window is considered to be the stall current. ENHANCED STRT: dI is a percentage drop in the stall current and ENHANCED STRT: dT defines the length of the time window.

    The DMP interprets a drop in the current greater than ENHANCED STRT: dI during the time window as indication of motor rotation and switches the time factor to the higher t6x TIME, as described under STALL TIME FACTOR.

    If the motor voltage signal is connected to the DMP, the Enhanced Starting logic accounts for any drop in the voltage accompanied by a drop in current. This increases security in case the system voltage drops due to other, unrelated activities during motor starting.

    Set ENHANCED STRT: dI to 5% unless special circumstances dictate otherwise. ENHANCED STRT: dT should be set as high as the locked rotor capability of the motor allows. It must provide a safe margin below the operating time of the Thermal Level 2 curve, based on the stall current and the overload curve lowered by the STALL TIME FACTOR.

    If dI is set to OFF, the motor rotation is determined based on the speed switch input. If it is set to a particular value, the rotation is determined by the logic and the speed switch input is ignored.

22. UNBALANCE LVL 2 – The DMP provides two levels of current unbalance protection. UNBALANCE LVL 2 sets the operating time as inversely proportional to the square of the percentage unbalance, with a minimum delay of 1 second. Figure 4–3 contains the characteristic curves for this function. The percentage unbalance is computed with the formula

$$\%\ \text{UNBALANCE} = 100 \cdot \left(I_{max} - I_{min}\right) / I_r$$

where $I_{max}$ is the largest of the three line currents, $I_{min}$ is the smallest of the three line currents, and $I_r$ is the larger of $I_{max}$ and MOTOR FLC.

This setting defines the threshold below which current unbalance protection is blocked. UNBALANCE LVL 1 is automatically set at 50% of UNBALANCE LVL 2, with a factory-set time delay of 1 second. The level 1 function is intended as an alarm, while level 2 serves as a trip.

23. U/B LVL 2 MAX T – This setting selects the characteristic curve from Figure 4–4 and represents the function's operating time at an unbalance of 10%.

## 4–6 Power Settings

This section contains descriptions of the parameters set with the Power category of the Settings menu. Table 4–6 lists the ranges of available values and the default settings.

1. RATED PF AT FLC – Set this to the rated power factor (PF) of the motor at full-load current, as supplied by the motor manufacturer. The DMP calculates the rated power of the motor using the following formula to process the underpower functions:

   Rated Power = 1.732 X (Line Voltage, Vn) X (Motor FLC) X (Rated PF).

2. UNDER PWR LVL 1 – The DMP provides two levels of underpower protection, with individually adjustable definite time delays. Underpower protection is operational only when the motor is in RUN mode. Level 1 is primarily intended as an alarm and is usually set higher than Level 2. Sustained underpower may be an indication of total or partial loss of motor load and may justify an alarm or trip. A three-phase voltage input is required for proper operation of these functions.

   Trip and alarm options for this function must be disabled if three-phase voltage is not connected to the DMP. See *Section 4–8 Tripping and Alarm Options* to configure these options.

3. U/P LVL 1 DELAY – Sets the time delay for the UNDER PWR LVL 1 function.

| Item | Parameter | Settings Range | Step Size | Default |
|---|---|---|---|---|
| 1 | RATED PF AT FLC | 0.50–0.99 | 0.01 | 0.88 |
| 2 | UNDER PWR LVL 1 | 5–99% of calculated rated power | 1% | 45% |
| 3 | U/ LVL 1 DELAY | 1–120 s | 1 s | 30 s |
| 4 | UNDER PWR LVL 2 | 5–99% of calculated rated power | 1% | 25% |
| 5 | U/P LVL 2 DELAY | 1–120 s | 1 s | 30 s |
| 6 | LOW POWER FACTOR | 0.20–0.98 (LAG) | 0.01 | 0.80 |
| 7 | LOW PF DELAY | 1–120 s | 1 s | 30 s |

*Table 4–6. Settings available in the Power category.*

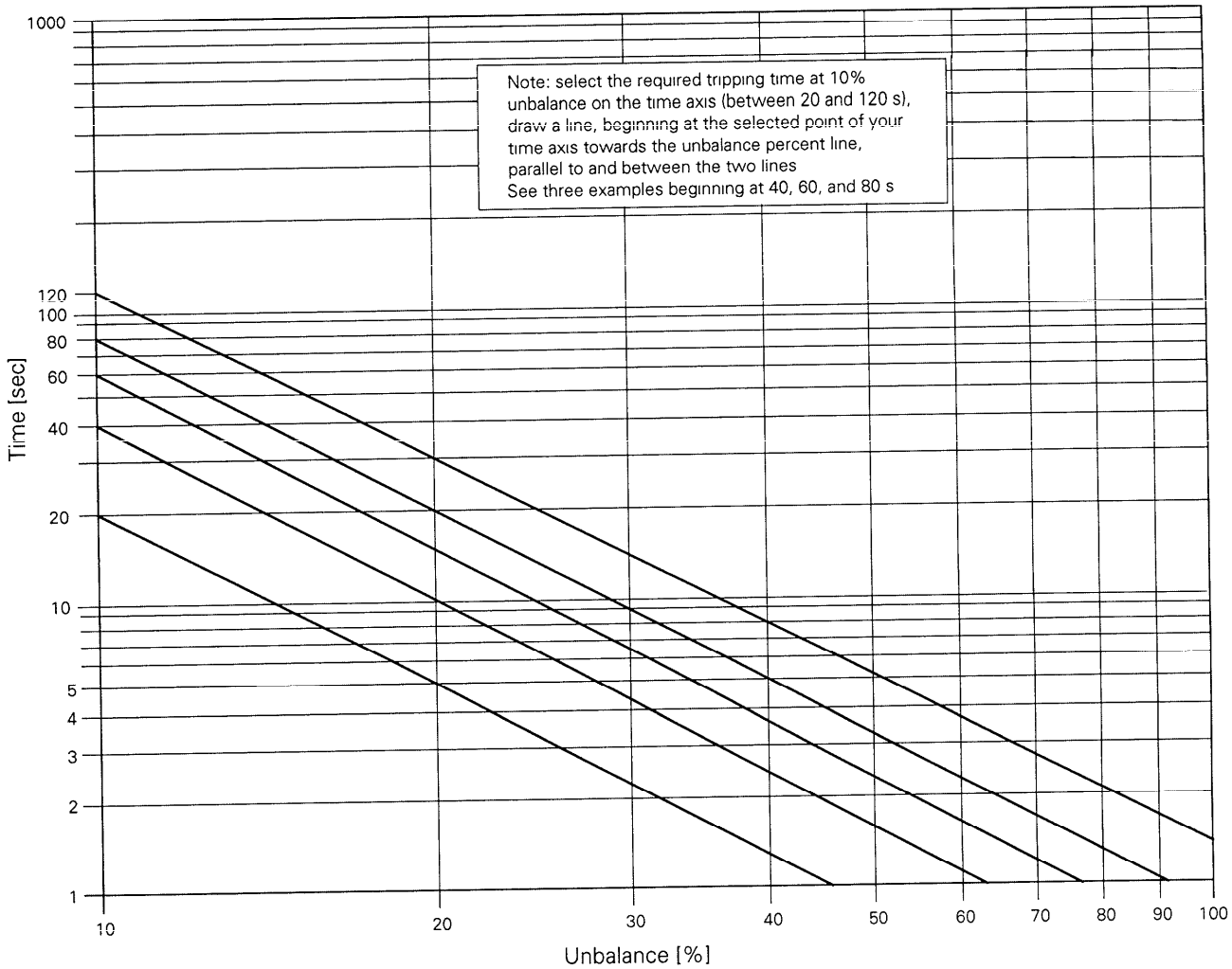



*Figure 4–4. Characteristic curves for current unbalance protection.*

4. UNDER PWR LVL 2 – This function is identical to UNDER PWR LVL 1, except that it is primarily intended as a trip and is usually set lower.

5. U/P LVL 2 DELAY – Sets the time delay for the UNDER PWR LVL 2 function.

6. LOW POWER FACTOR – Low power factor protection operates when the lagging power factor drops below the set value for a time longer than the LOW PF DELAY. It is operational only when the motor is in RUN mode. This function can be used to detect a loss of power factor correction in an induction motor or a loss of field in a synchronous motor.

   A three-phase voltage input is required for operation of this function. Trip and alarm options for this function must be disabled if three-phase voltage is not connected to the DMP. See *Section 4–8 Tripping and Alarm Options* to configure these options.

7. LOW PF DELAY – Sets the definite time delay for low power factor protection.

## 4–7 Temperature Settings

This section contains descriptions of the parameters set with the Temperature category of the Settings menu. Table 4–7 lists the ranges of available values and the default settings.

**1.** RTD TYPE – Two distinct families of DMP models cover the three types of resistance–temeprature detectors (RTDs). Before setting this item, verify that the DMP model in use matches the type of available RTDs and also that the resistance values of the RTDs matches those given in Table 1–1.

**2–21.** RTD X LVL 1, RTD X LVL 2 – The DMP back panel has ten inputs for RTDs. Each RTD has two levels of settings available. Level 1 is normally intended as an alarm and is set lower than Level 2, which is intended as a trip. In addition, the DMP will alarm and block tripping by an open RTD. These settings should be based on motor insulation temperature class and/or bearing temperature limits, with adequate margins.

| Item | Parameter | Settings Range | Step Size | Default |
|---|---|---|---|---|
| 1 | RTD TYPE | COPPER 10 OHM, PLATINUM 100 OHM, NICKEL 120 OHM | — | PLATINUM 100 OHM |
| 2 | RTD 1 LVL 1 | 0–200 C | 1° C | 120 C |
| 3 | RTD 1 LVL 2 | 0–200 C | 1° C | 140 C |
| 4 | RTD 2 LVL 1 | 0–200 C | 1° C | 120 C |
| 5 | RTD 2 LVL 2 | 0–200 C | 1° C | 140 C |
| 6 | RTD 3 LVL 1 | 0–200 C | 1° C | 120 C |
| 7 | RTD 3 LVL 2 | 0–200 C | 1° C | 140 C |
| 8 | RTD 4 LVL 1 | 0–200 C | 1° C | 120 C |
| 9 | RTD 4 LVL 2 | 0–200 C | 1° C | 140 C |
| 10 | RTD 5 LVL 1 | 0–200 C | 1° C | 120 C |
| 11 | RTD 5 LVL 2 | 0–200 C | 1° C | 140 C |
| 12 | RTD 6 LVL 1 | 0–200 C | 1° C | 120 C |
| 13 | RTD 6 LVL 2 | 0–200 C | 1° C | 140 C |
| 14 | RTD 7 LVL 1 | 0–200 C | 1° C | 80 C |
| 15 | RTD 7 LVL 2 | 0–200 C | 1° C | 100 C |
| 16 | RTD 8 LVL 1 | 0–200 C | 1° C | 80 C |
| 17 | RTD 8 LVL 2 | 0–200 C | 1° C | 100 C |
| 18 | RTD 9 LVL 1 | 0–200 C | 1° C | 80 C |
| 19 | RTD 9 LVL 2 | 0–200 C | 1° C | 100 C |
| 20 | RTD 10 LVL 1 | 0–200 C | 1° C | 80 C |
| 21 | RTD 10 LVL 2 | 0–200 C | 1° C | 100 C |

*Table 4–7. Settings available in the Temperature category.*

## 4–8 Tripping and Alarm Options

The protection functions described in this chapter and in *Chapter 1 – Product Description* are consolidated into 48 items and listed in Table 4–9. Each function has five options that can be individually enabled or disabled, as follows:

- TRIP – When this option is enabled, the DMP performs the following operations when the function operates:
  - Turns on the TRIP LED.
  - De-energizes output relays A and B.
  - Energizes output relay D if it is configured as TRIP.
  - De-energizes output relay D if it is configured as TRIP-FAIL SAFE.
- ALARM – When this option is enabled, The DMP performs the following operations when the function operates:
  - Turns on the ALARM LED.
  - De-energizes output relay C if it is configured as ALARM.
- AUTO RST – If this option is enabled, the DMP automatically resets when the condition causing the function to operate has reverted to normal. This option also resets any TRIP or ALARM message on the LCD. The fault data in the DMP memory is retained. This option should be kept disabled unless particular conditions warrant its use.
- PANEL RST – If this option is enabled and the DMP is in Local Control mode, the DMP can be reset from the front panel following operation of the function, without authorized key switch input. This option should be disabled for all critical protection functions that must be reported or recorded before reset. A person with authorized key may always reset the DMP regardless of this setting.
- PLC RESET – If this option is enabled and the DMP is in PLC (programmable logic controller) mode, the DMP can be reset from the PLC RESET input contact following operation of the function. If a PLC is not used, this function should be disabled.

The following points must be considered when setting TRIP and ALARM options:

1. If the voltage signal input is single-phase or if no voltage signal input is connected to the DMP, both TRIP and ALARM functions must be disabled, as shown in Table 4–8.
2. If any of the three external fault 1, 2, or 3 is not used, both TRIP and ALARM options of that function must be DISABLED.
3. The functions CONTROL CIRCUIT OPEN and WELDED CONTACTOR are applicable only if PROTECTION ONLY is set to NO. Disable both TRIP and ALARM options of these functions if PROTECTION ONLY is set to YES.

| | *Voltage Signal Input Connected* | | |
|---|---|---|---|
| ***Function*** | ***Three-Phase Input*** | ***Single-Phase Input*** | ***No Voltage Input*** |
| UNDERVOLTAGE | No limitations | No limitations | DISABLE |
| O/V LVL 1 and 2 | No limitations | No limitations | DISABLE |
| PHASE LOSS | No limitations | DISABLE | DISABLE |
| PHASE SEQUENCE | No limitations | DISABLE | DISABLE |
| UNDER PWR 1 and 2 | No limitations | DISABLE | DISABLE |
| LOW POWER FACTOR | No limitations | DISABLE | DISABLE |

*Table 4–8. TRIP and ALARM setting limitations on voltage-dependent functions.*

| Item # | Function | Trip | Alarm | Auto Rst | Panel Rst | PLC Rst | When Active |
|---|---|---|---|---|---|---|---|
| 1 | MAX START TIME | DSABL | ENABL | DSABL | ENABL | ENABL | START |
| 2 | TOO MANY STARTS | DSABL | DSABL | DSABL | ENABL | ENABL | START |
| 3 | U/C LEVEL 1 | DSABL | ENABL | DSABL | ENABL | ENABL | RUN |
| 4 | U/C LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | RUN |
| 5 | LOAD INCREASED | DSABL | ENABL | DSABL | ENABL | ENABL | RUN |
| 6 | O/C LEVEL 1-JAM | ENABL | ENABL | DSABL | ENABL | ENABL | RUN |
| 7 | O/C LVL2-SHORT | ENABL | ENABL | DSABL | ENABL | ENABL | Always |
| 8 | THERMAL LEVEL 1 | DSABL | ENABL | DSABL | ENABL | ENABL | Always |
| 9 | THERMAL LEVEL 2 | ENABL | ENABL | DSABL | ENABL | ENABL | Always |
| 10 | UNBALANCE LVL 1 | DSABL | ENABL | DSABL | ENABL | ENABL | Always |
| 11 | UNBALANCE LVL 2 | ENABL | ENABL | DSABL | ENABL | ENABL | Always |
| 12 | UNDERVOLTAGE | DSABL | ENABL | DSABL | ENABL | ENABL | RUN & START |
| 13 | O/V LEVEL 1 | DSABL | ENABL | DSABL | ENABL | ENABL | RUN & START |
| 14 | O/V LEVEL 2 | ENABL | ENABL | DSABL | ENABL | ENABL | RUN & START |
| 15 | PHASE LOSS | ENABL | ENABL | DSABL | ENABL | ENABL | Always |
| 16 | PHASE SEQUENCE | ENABL | ENABL | DSABL | ENABL | ENABL | Always |
| 17 | GND FLT LVL 1 | DSABL | ENABL | DSABL | ENABL | ENABL | Always |
| 18 | GND FLT LVL 2 | ENABL | ENABL | DSABL | DSABL | DSABL | Always |
| 19 | COMM PORT FAILED | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 20 | INTERNAL FAILURE | DSABL | ENABL | DSABL | DSABL | DSABL | Always |
| 21 | CONTROL CIR OPEN | DSABL | DSABL | DSABL | ENABL | ENABL | PRE-START |
| 22 | WELDED CONTACTOR | DSABL | DSABL | DSABL | ENABL | ENABL | PRE-STOP |
| 23 | EXTERNAL FAULT 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 24 | EXTERNAL FAULT 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 25 | EXTERNAL FAULT 3 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 26 | RTD 1 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 27 | RTD 1 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 28 | RTD 2 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 29 | RTD 2 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 30 | RTD 3 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 31 | RTD 3 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 32 | RTD 4 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 33 | RTD 4 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 34 | RTD 5 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 35 | RTD 5 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 36 | RTD 6 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 37 | RTD 6 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 38 | RTD 7 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 39 | RTD 7 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 40 | RTD 8 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 41 | RTD 8 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 42 | RTD 9 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 43 | RTD 9 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 44 | RTD 10 - LEVEL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 45 | RTD 10 - LEVEL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | Always |
| 46 | UNDER PWR LVL 1 | DSABL | DSABL | DSABL | ENABL | ENABL | RUN |
| 47 | UNDER PWR LVL 2 | DSABL | DSABL | DSABL | ENABL | ENABL | RUN |
| 48 | LOW POWER FACTOR | DSABL | DSABL | DSABL | ENABL | ENABL | RUN |

*Table 4–9. DMP protection functions and default settings for each tripping and alarming option.*

**Location** _____ **Motor Identification** _____

**Model Number** DMP1 **Program Version** DMP

| Item # | Description | | Setting |
|---|---|---|---|
| – | Power Supply Switch (applicable to models with ac power supply only) | | |
| | ***Set Menu Category: Communication Settings*** | | |
| 1 | MOTOR NUMBER | Identification Number | |
| 2 | BAUD RATE | Communications baud rate | |
| 3 | ADDRESS NO. | Serial link address number | |
| 4 | FUTURE ENH. 1 | (for future use) | NOT USED |
| 5 | FUTURE ENH. 2 | (for future use) | NOT USED |
| 6 | FUTURE ENH. 3 | (for future use) | NOT USED |
| | ***Set Menu Category: System Parameter Settings*** | | |
| 1 | LINE VOLTS (Vn) | Rated primary voltage, line to line | |
| 2 | LINE FREQUENCY | Nominal system frequency | |
| 3 | VT PRIMARY | Rated voltage – VT primary winding | |
| 4 | VT SECONDARY | Rated voltage – VT secondary winding | |
| 5 | MOTOR FLC | Motor full-load current (FLC) – primary amperes | |
| 6 | CT PRIMARY | Rated primary current – phase CTs | |
| 7 | GND CT PRIMARY | Rated primary current – ground CT | |
| 8 | GND FAULT LVL 1 | Ground overcurrent pickup level 1 – % of FLC | |
| 9 | G/F LVL 1 DELAY | Ground overcurrent level 1 delay - seconds | |
| 10 | GND FAULT LVL 2 | Ground overcurrent pickup level 2 – % of FLC | |
| 11 | G/F LVL 2 DELAY | Ground overcurrent level 2 delay - seconds | |
| 12 | CURRENT INHIBIT | Inhibit current – % of FLC | |
| 13 | START/STP SIGNAL | START and STOP signals | |
| 14 | STARTING METHOD | Starting method | |
| 15A | MAX TIME IN START | Maximum time in star/wye – seconds | |
| 15B | TRANSITION TIME | Star-Delta overlap time – seconds | |
| 15C | STAR TO DELTA AT | Current level for star to delta transition – % of FLC | |
| 16A | LOW SPEED FLC | Full-load current at low speed for two-speed motor – primary amperes | |
| 16B | LOW SPD t6x TIME | t6x time factor at low speed for two-speed motor – seconds | |
| 17 | CONFIG OUTPUT C | Configuration of output relay C | |
| 18 | OUPUT C DELAY | Time delay of output relay C – seconds | |
| 19 | CONFIG OUTPUT D | Configuration of output relay D | |
| 20 | OUPUT D DELAY | Time delay of ouput relay D – seconds | |
| 21 | PROTECTION ONLY | Operating mode of DMP system | |
| | ***Set Menu Category: Voltage Settings*** | | |
| 1 | U/V LEVEL | Undervoltage threshold level – % of Vn | |
| 2 | U/V DELAY | Time delay of undervoltage function – seconds | |
| 3 | U/V STRT PREVENT | Minimum voltage required to start motor – % of Vn | |
| 4 | U/V AUTO RESTART | Auto restart of motor following momentary loss of ac power supply | |
| 5 | U/V RSTRT DELAY | Time delay for U/V AUTO RESTART function – seconds | |
| 6 | O/V LEVEL 1 | Overvoltage threshold level 1 – % of Vn | |
| 7 | O/V LEVEL 2 | Overvoltage threshold level 2 – % of Vn | |
| 8 | O/V LVL 2 DELAY | Time delay of O/V LEVEL 2 function – seconds | |

**Location** _____ **Motor Identification** _____

**Model Number** DMP1 **Program Version** DMP

| Item # | Description | | Setting |
|---|---|---|---|
| | ***Set Menu Category: Current Settings*** | | |
| 1 | MAX START TIME | Maximum motor starting time allowed – seconds | |
| 2 | NUMBER OF STARTS | Maximum number of starts allowed within STARTS PERIOD | |
| 3 | STARTS PERIOD | Time period for NUMBER OF STARTS – minutes | |
| 4 | START INHIBIT | Start inhibit time following a TOO MANY STARTS condition – minutes | |
| 5 | U/C LEVEL 1 | Undercurrent threshold level 1 – % of FLC | |
| 6 | U/C LEVEL 1 DELAY | Time delay for U/C LEVEL 1 function – seconds | |
| 7 | U/C LEVEL 2 | Undercurrent threshold level 2 – % of FLC | |
| 8 | U/C LEVEL 2 DELAY | Time delay for U/C LEVEL 2 function – seconds | |
| 9 | LOAD INCREASE | Threshold level of Load Increase function – % of FLC | |
| 10 | O/C LEVEL 1 - JAM | Overcurrent threshold level 1 – % of FLC | |
| 11 | O/C LVL 1 DELAY | Time delay of O/C LEVEL 1 function – seconds | |
| 12 | O/C LEVEL 2 - SHORT | Overcurrent threshold level 2 – % of FLC | |
| 13 | O/C LVL 2 DELAY | Time delay of O/C LEVEL 2 function – seconds | |
| 14 | OVERLOAD PICKUP | Pickup level of thermal overload function – % of FLC | |
| 15 | THERMAL LEVEL 1 | Operate level 1 of thermal overload function – % of Thermal Capacity | |
| 16 | t6x TIME | t6x time factor of thermal overload function – seconds | |
| 17 | HOT/COLD RATIO | Thermal capability of Hot motor in % of capability of Cold motor | |
| 18 | COOL TIME FACTOR | Ratio of cooling time constant of stopped motor to running motor | |
| 19 | STALL TIME FCTR | Heating time constant of stopped motor as % of running motor | |
| 20 | ENHANCED STRT:dI | Decrement in current during motor start – % of stall current | |
| 21 | ENAHNCED STRT:dT | Time window for ENHANCED STRT:dI setting – seconds | |
| 22 | UNBALANCE LVL 2 | Unbalance current threshold level 2 – % | |
| 23 | U/B LVL 2 MAX T | Operate time at unbalance current of 10% – seconds | |
| | ***Set Menu Category: Power Settings*** | | |
| 1 | RATED PF AT FLC | Rated power factor at motor full-load current | |
| 2 | UNDER PWR LVL 1 | Underpower threshold level 1 – % of rated power | |
| 3 | U/P LVL 1 DELAY | Time delay of UNDER PWR LVL 1 function – seconds | |
| 4 | UNDER PWR LVL 2 | Underpower threshold level 2 – % of rated power | |
| 5 | U/P LVL 2 DELAY | Time delay of UNDER PWR LVL 2 function – seconds | |
| 6 | LOW POWER FACTOR | Low power factor threshold | |
| 7 | LOW PF DELAY | Time delay of LOW POWER FACTOR function – seconds | |
| | ***Set Menu Category: Temperature Settings*** | | |
| 1 | RTD TYPE | Type of RTDs used | |
| 2 | RTD 1 LVL 1 | Temperature threshold level 1 of RTD 1 – °C | |
| 3 | RTD 1 LVL 2 | Temperature threshold level 2 of RTD 1 – °C | |
| 4 | RTD 2 LVL 1 | Temperature threshold level 1 of RTD 2 – °C | |
| 5 | RTD 2 LVL 2 | Temperature threshold level 2 of RTD 2 – °C | |
| 6 | RTD 3 LVL 1 | Temperature threshold level 1 of RTD 3 – °C | |
| 7 | RTD 3 LVL 2 | Temperature threshold level 2 of RTD 3 – °C | |
| 8 | RTD 4 LVL 1 | Temperature threshold level 1 of RTD 4 – °C | |
| 9 | RTD 4 LVL 2 | Temperature threshold level 2 of RTD 4 – °C | |

**Location** _____ **Motor Identification** _____

**Model Number** DMP1 **Program Version** DMP

| Item # | Description | | Setting |
|---|---|---|---|
| | ***Set Menu Category: Temeprature Settings (cont.)*** | | |
| 10 | RTD 5 LVL 1 | Temperature threshold level 1 of RTD 5 – °C | |
| 11 | RTD 5 LVL 2 | Temperature threshold level 2 of RTD 5 – °C | |
| 12 | RTD 6 LVL 1 | Temperature threshold level 1 of RTD 6 – °C | |
| 13 | RTD 6 LVL 2 | Temperature threshold level 2 of RTD 6 – °C | |
| 14 | RTD 7 LVL 1 | Temperature threshold level 1 of RTD 7 – °C | |
| 15 | RTD 7 LVL 2 | Temperature threshold level 2 of RTD 7 – °C | |
| 16 | RTD 8 LVL 1 | Temperature threshold level 1 of RTD 8 – °C | |
| 17 | RTD 8 LVL 2 | Temperature threshold level 2 of RTD 8 – °C | |
| 18 | RTD 9 LVL 1 | Temperature threshold level 1 of RTD 9 – °C | |
| 19 | RTD 9 LVL 2 | Temperature threshold level 2 of RTD 9 – °C | |
| 20 | RTD 10 LVL 1 | Temperature threshold level 1 of RTD 10 – °C | |
| 21 | RTD 10 LVL 2 | Temperature threshold level 2 of RTD 10 – °C | |

***Set Menu Category: Tripping/Alarm Options***

***Options Range – Set each to Enable (ENABL) or Disable (DSABL)***

| | | Option Setting | | | | | |
|---|---|---|---|---|---|---|---|
| ***Item #*** | ***Functon*** | ***TRIP*** | ***ALARM*** | ***AUTO RST*** | ***PANEL RST*** | ***PLC RESET*** | ***ACTIVE DURING*** |
| 1 | MAX START TIME | | | | | | START |
| 2 | TOO MANY STARTS | | | | | | START |
| 3 | U/C LEVEL 1 | | | | | | RUN |
| 4 | U/C LEVEL 2 | | | | | | RUN |
| 5 | LOAD INCREASED | | | | | | RUN |
| 6 | O/C LEVEL 1-JAM | | | | | | RUN |
| 7 | O/C LVL 2-SHORT | | | | | | ALWAYS |
| 8 | THERMAL LEVEL 1 | | | | | | ALWAYS |
| 9 | THERMAL LEVEL 2 | | | | | | ALWAYS |
| 10 | UNBALANCE LVL 1 | | | | | | ALWAYS |
| 11 | UNBALANCE LVL 2 | | | | | | ALWAYS |
| 12 | UNDERVOLTAGE | | | | | | RUN&START |
| 13 | O/V LEVEL 1 | | | | | | RUN&START |
| 14 | O/V LEVEL 2 | | | | | | RUN&START |
| 15 | PHASE LOSS | | | | | | ALWAYS |
| 16 | PHASE SEQUENCE | | | | | | ALWAYS |
| 17 | GND FLT LVL 1 | | | | | | ALWAYS |
| 18 | GND FLT LVL 2 | | | | | | ALWAYS |
| 19 | COMM PORT FAILED | | | | | | ALWAYS |
| 20 | INTERNAL FAILURE | | | | | | ALWAYS |
| 21 | CONTROL CIR OPEN | | | | | | PRESTART |
| 22 | WELDED CONTACTOR | | | | | | PRESTOP |
| 23 | EXTERNAL FAULT 1 | | | | | | ALWAYS |
| 24 | EXTERNAL FAULT 2 | | | | | | ALWAYS |
| 25 | EXTERNAL FAULT 3 | | | | | | ALWAYS |

Location _____ Motor Identification _____

Model Number DMP1 Program Version DMP

**Set Menu Category: Tripping/Alarm Options (cont.)**

**Options Range – Set each to Enable (ENABL) or Disable (DSABL)**

| | | Option Setting | | | | | |
|---|---|---|---|---|---|---|---|
| Item # | Funcion | TRIP | ALARM | AUTO RST | PANEL RST | PLC RESET | ACTIVE DURING |
| 26 | RTD 1 - LEVEL 1 | | | | | | ALWAYS |
| 27 | RTD 1 - LEVEL 2 | | | | | | ALWAYS |
| 28 | RTD 2 - LEVEL 1 | | | | | | ALWAYS |
| 29 | RTD 2 - LEVEL 2 | | | | | | ALWAYS |
| 30 | RTD 3 - LEVEL 1 | | | | | | ALWAYS |
| 31 | RTD 3 - LEVEL 2 | | | | | | ALWAYS |
| 32 | RTD 4 - LEVEL 1 | | | | | | ALWAYS |
| 33 | RTD 4 - LEVEL 2 | | | | | | ALWAYS |
| 34 | RTD 5 - LEVEL 1 | | | | | | ALWAYS |
| 35 | RTD 5 - LEVEL 2 | | | | | | ALWAYS |
| 36 | RTD 6 - LEVEL 1 | | | | | | ALWAYS |
| 37 | RTD 6 - LEVEL 2 | | | | | | ALWAYS |
| 38 | RTD 7 - LEVEL 1 | | | | | | ALWAYS |
| 39 | RTD 7 - LEVEL 2 | | | | | | ALWAYS |
| 40 | RTD 8 - LEVEL 1 | | | | | | ALWAYS |
| 41 | RTD 8 - LEVEL 2 | | | | | | ALWAYS |
| 42 | RTD 9 - LEVEL 1 | | | | | | ALWAYS |
| 43 | RTD 9 - LEVEL 2 | | | | | | ALWAYS |
| 44 | RTD 10 - LEVEL 1 | | | | | | ALWAYS |
| 45 | RTD 10 - LEVEL 2 | | | | | | RUN |
| 46 | UNDER PWR LVL 1 | | | | | | RUN |
| 47 | UNDER PWR LVL 2 | | | | | | RUN |
| 48 | LOW POWER FACTOR | | | | | | |

**GE Protection & Control**

*General Electric Company*
*205 Great Valley Parkway, Malvern, PA 19355*

*GEK–100686 0695*