SOLCON™ POWERED

MPS6

MOTOR PROTECTION SYSTEM

Version: September 18, 2007

CHANGES FROM MPR6/MPC6 TO MPS6

1. Six programmable discrete (digital) inputs to the MPS6.
2. Six Programmable Output Relays.
3. One programmable Analog output
4. Real time clock.
5. Statistical Data of last 10 trips with time & date stamp.
6. Switched Mode power supply for AC or DC (one unit from 85V to 230V)
7. Two Serial Link communication channels (Rear and Front). Front is 9600 (fixed) baud, RS232, Modbus RTU. Rear is RS485 Modbus RTU up to 38400 bps, or optionally Profibus.
8. MPS6 includes 3 Temperature sensors. Circuit can be internally set by dip switches for PT100 or for Thermistors (to be specified in order).
9. Control function (for MPS6-C) with MODBUS function 6 and 16. Functions 1,2,5,15 are canceled.
10. MODBUS new group of 20 user selected actual data parameters for fast scanning.
11. Unbalance calculation using Negative and Positive Sequence instead Imax and Imin.
12. UNBALANCE MIN T (unbalance minimum time = 1...30 sec.) new parameter to prevent too fast response.
13. Standard “American” Thermal Overload curves
14. RTD Bias (of thermal overload)
15. Unbalance Bias (Of Thermal Overload)
16. New program for current, voltage and temperature **fault simulation**. (useful for testing and for learning the MPS6, "on the engineer table")
17. Power measurement.
18. KWH (Energy) Display and KWH output (pulse relay)
19. Too Many Starts Pre Alarm can be configured to energize output relay.
20. (I > 0) After Trip can be configured to energize output relay B (to trip upstream breaker).
21. Every fault group can be configured to energize output relays A, B and/or C.
22. NO START PROCESS new setting of STARTING METHOD, to allow switching to run, if I>= 10%.
23. Capture and display of minimum and maximum RMS average (of three phases) voltage and current. Capture of minimum and maximum frequency.
24. G/F During Start setting, new feature to eliminate nuisance ground fault tripping when residual CT connection (not required with Core Balance) is used.
25. New Emergency Restart function. Reset of Thermal capacity by pressing reset twice is canceled.
26. Modified Restart- after mains failure or Auxiliary Power Supply failure.
27. Separate Aux Power Supply and Control Voltage.
28. KVARH, added.
29. New setting parameter UV ACTIVE AT STOP, to enable/disable Under Voltage protection at stop.
30. Thermal capacity count down even when MPS6 is not powered, using Real Time Clock

TABLE OF CONTENTS

TABLE OF CONTENTS

Notes:

1. *Installation, operation and maintenance should be in strict accordance with the instructions in this manual, national codes and good practice. Installation or operation not performed in strict accordance with these instructions shall void the manufacturer's warranty.*
2. *Disconnect all power inputs before wiring or servicing the equipment.*
3. *The company reserves the right to make any improvements or modifications to its products without prior notice.*

Warning:

Unit must be grounded to ensure correct operation and safety.

.

INTRODUCTION

The MPS6 Motor Protection System is a new generation of micro controller based relay / controller designed to operate with a three (3) phase induction motors.

True RMS voltages and currents are measured at a sampling rate of 0.5 ms, enables the MPS6 to be used with electronic motor drives like soft starters.

The MPS6 incorporates two main features.
a. Motor protection.
b. Supervision and communication.

The MPS6-C is identical to MPS6 , but incorporates in addition to all MPS6 features, a motor control capabilities.

Protection Features

AC motors are very rugged and reliable when operating within product specification limits. However, they are usually designed to operate close to their rated limits with minimal margins for operating under abnormal conditions. A comprehensive protection device is required to accurately create a Thermal Modeling, in order to allow motor run safely up to its limits. The Thermal Model is based mainly on currents, but it may be biased also by RTD and by Unbalance Currents.

This relay should protect the motor from abnormal conditions in the mains voltage, motor and cabling faults as well as operator malfunctions.

The MPS6 monitors one phase voltage, three phase + ground fault currents, temperature inputs from up to 3 sensors and six programmable Discrete (Optically isolated logical) inputs.

The MPS6 incorporates one programmable Analog Output as well as six programmable output relays. Four relays are of the N.O. type with one common line to all four. The other two relays are change-over (form C) type. One or more relays can be configured as Trip and / or Alarm. All inputs and outputs are combined to provide the most comprehensive protection package. It is also possible to assign certain faults to each one of the relays A,B or C.

The MPS6 can handle 32 different trips / alarms.

Voltage base protections	Under-voltage, Over-voltage, Restart.
Current base protections	Too many starts, Under current, Load increase, Over-current level 1 (Stall/Locked protection), Over-current level 2 (Short circuit) Thermal Overload, Unbalanced current, Ground fault current.
Voltage/Current based protections	Under power, Low power factor.
Temperature based	Up to 3 sensors (RTDs or thermistors, to be specified in order).
General based protection	Contactor Status fault (only for MPS6-C), Two external faults, Rear Comm. Port Failure.
Two levels for most faults	Usually used for Alarm and Trip.

Protection levels and time delay settings are individually configured using the key pad on the front panel or through

rear or front communication.

Unique Tripping / Alarm options make it possible to program any fault as an Alarm, Trip, both or none. It allows also to prevent resetting of certain faults. This unique facility also enables controlled fault Reset possibilities. Authorized key, extends the reset possibilities. User can also assign certain faults to each one of the relays A, B and C
A unique calculated **"Time to Trip"** feature allows the operator or host computer to take corrective actions before tripping.

Control Features

The MPS6-C has the same functionality as the MPS6 and also incorporates also control capabilities. It can control various starting methods like Direct Online, Star Delta, Soft Starters, Reversing and Two Speeds.

Six optically isolated logic inputs are used to enable many types of control: Local, remote (for PLC without serial link) or through RS485 serial link.

Two or three relays may be used to control DOL (direct online), Star/Delta, Soft-starters, Two Speed and Reversing -starting.

Throughout the entire document MPS6–C information is written over a gray background. Please ignore this information for the MPS6.

Supervision and Communication Features

A Liquid Crystal Display (LCD), together with a keypad and LEDs enables user friendly interface, accurate digital parameters setting, actual parameters readings, and detailed trip and alarm message displays. Unauthorized setting changes can easily be prevented by the correct use of the Authorized key input terminals.

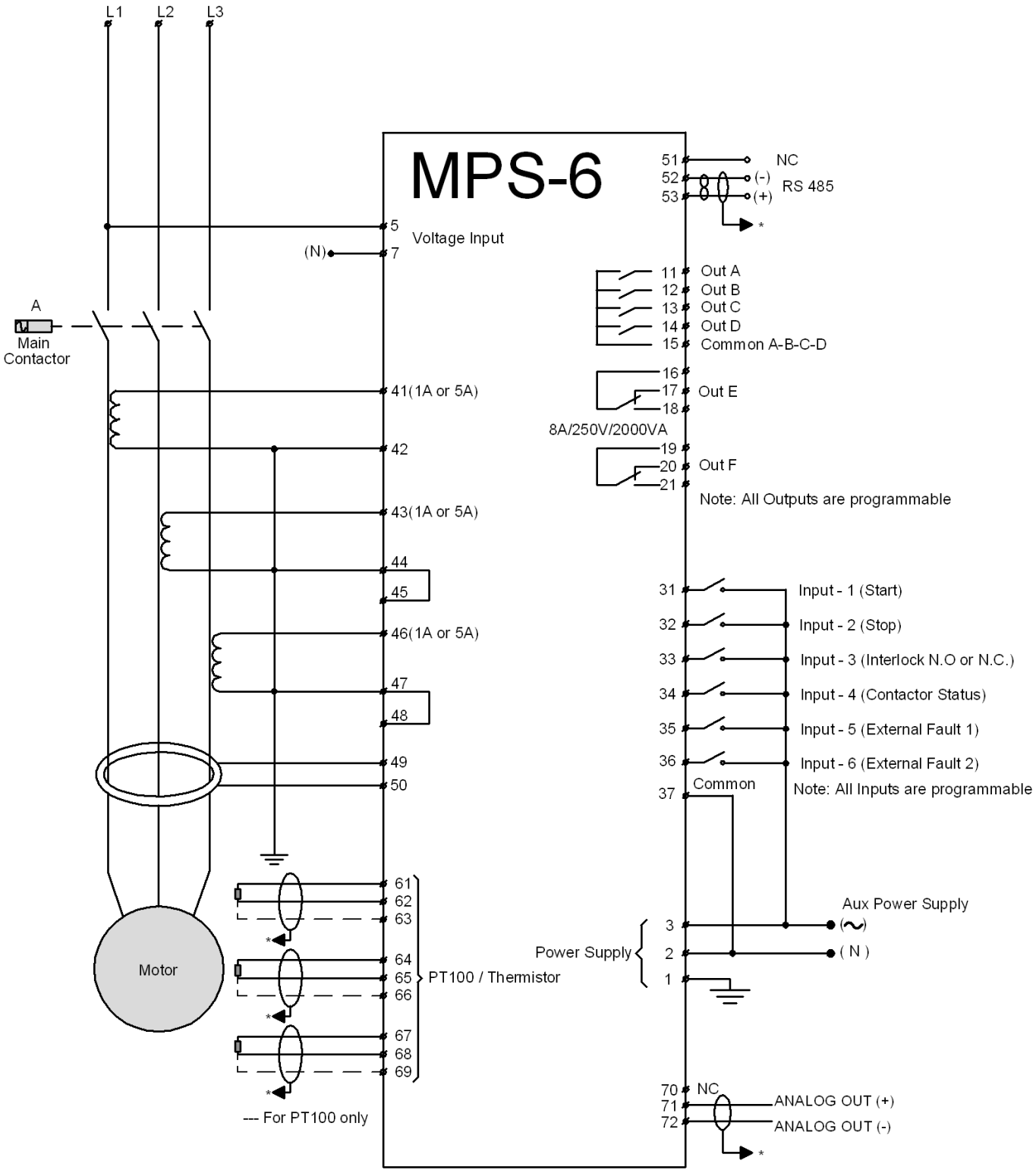
Measured data	Phase and line voltage, Phase currents, Ground fault current, Power, Reactive Power, Power factor and RTD temperatures (thermistor resistances).
Calculated data	Motor load in % of FLC, Equivalent motor current, Unbalance current, Thermal Capacity, Time to trip, Time to start.
Logic inputs status	Individual status of all input contacts.
Statistical data	Motors running hours, Total number of starts, Total number of trips, Last start time, last start peak current, Total Energy, minimum and maximum values of voltage, current and frequency.
Fault data	Last Trip, Last Alarm, Phase currents at time of trip, Ground fault current at time of trip, Phase voltages at time of trip, last 10 faults with time and date stamp.
Fault Simulation –	Special Test / Maintenance page allows simulation (only during first 10 hours from auxiliary supply power up) by setting voltages, currents and temperature “actual” values. The Simulation mode can be used for periodic testing of the relay. It can be used also for getting familiar with the MPS6 modes of operation and features.

Rear RS485 serial link (with MODBUS RTU communication protocol, or optionally Profibus protocol), operating at baud rate of 1200 to 38400 bps and front RS232 with Modbus RTU operating at a fixed 9600 bps, enables monitoring of both the "set page" and actual parameters. Changes of the "set page" parameters through the serial links make it very easy to enter user’s set points in place of the factory default parameters. The serial link enables remote control of both the MPS6 and the motor.

RS485 enables 32 MPS6 units to be connected on the same link to the host computer. When a need for more than 32 units arises, using MMI & Data highway equipment non limited number of MPS6's can be connected to a host computer.

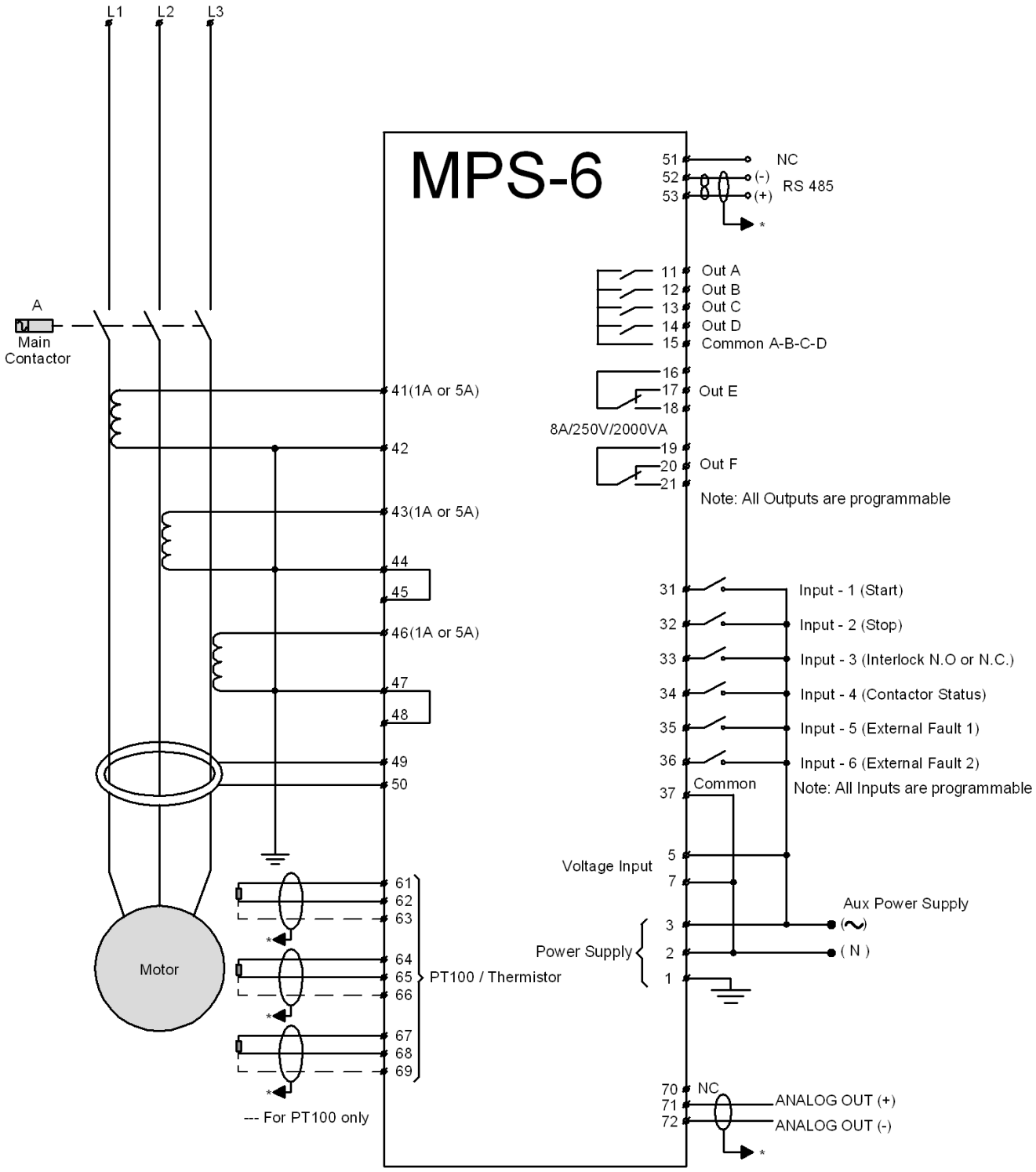
WIRING DIAGRAM - MPS6-C

MPS-6 Typical Wiring Diagram

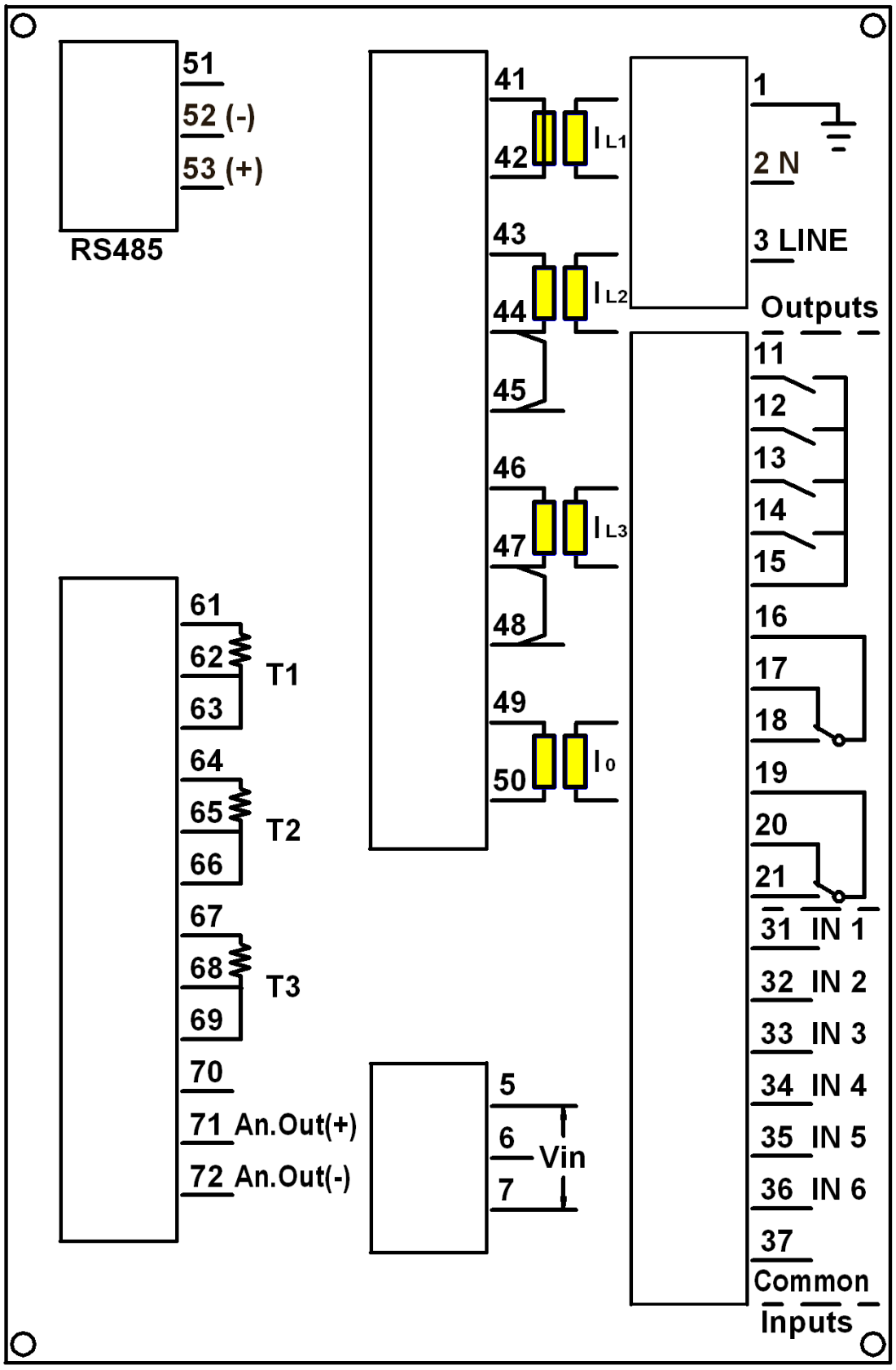


WIRING DIAGRAM - MPS6-C

MPS-6 Typical Wiring Diagram Using One Voltage Source



REAR PANEL - MPS6 and MPS6-C



MPS6 TERMINALS

Auxiliary Power Supply

85…230VDC or AC (50/60) Hz
Phase or DC (+) **3**
Neutral or DC (-) **2**
Ground **1**

Current & Voltage & Temperature (RTD, Thermistor) inputs

The MPS6 can measure: One voltage, four currents and three temperature sensors. True RMS measurement is used both for voltage and currents. Frequency should be in the range of 45-66 Hz. All current and voltage inputs incorporate internal isolating transformers.

Voltage Input

Direct connection of voltage up to 400 VAC.
Voltage terminals are:
Phase **5**
Neutral **7**
Note: Vin = input voltage to terminals 5 and 7, must be connected for frequency sensing. If voltage input is not available, current measurements are accurate only if frequency is 50Hz or 60Hz, as set.

Line Currents

Currents measured through "C/T" secondary of 5 A (or 1 A by special order).
Phase L1 ..... **41, 42**
Phase L2 ..... **43, 44 & 45**
Phase L3 ..... **46, 47 & 48**

Ground Fault Current

Currents measured through a Core Balance "C/T"
All phases..... **49, 50**
Note: It is recommended to use Core Balance "C/T". If a Core Balance "C/T" is not available, Ground Fault can be measured according to "C/T" Wiring Diagrams on Page ??.

Temperature Sensors

The MPS6 can accept inputs from Up to 3 Platinum 100 Ohm RTDs or thermistors.
LCD display is in °C (see temperature table on page ??).
Note: All sensors must be of same type (all RTDs or all thermistors).

RTDs three wire measurement system is used to compensate for cable resistance. (max. cable resistance allowed is 25% of sensor resistance at 0°C). Only two wires are used for thermistor.
T1 ..... **61+62, 63** (Leave 63 open for thermistor)
T2 ..... **64+65, 66** (Leave 66 open for thermistor)
T3 ..... **67+68, 69** (Leave 69 open for thermistor)
Note - If Temp sensors are not used, leave all relevant terminals open. Disable all the relevant Trip and Alarms. Twisted and Shielded cables must be used for all temperature inputs. Shield should be connected to Chassis Ground externally, near the MPS6.
Disconnected Temperature Sensor
The MPS-6contains “Disconnected Temp. Sensor” feature, which detects a missing sensor and signals the “Alarm”, but not the “Trip”. Normally, when a sensor’s temperature is very high, the MPS-6 will trip on high temperature. When temperature reading becomes infinite rapidly, it will only Alarm and will not Trip. Temp. measurement will show ????.

Analog Output

The MPS6 incorporates one programmable analog output. Outputs type can be programmed to 4..20 mA or

0..20 mA. Load resistance should be less than 400Ω. The Analog output can be configured to represent one of eleven different parameters. Output is updated 30 times per sec. Range of parameter for the output is fully programmable.
Analog Out **71**
Analog Out Common **72**
Note: The analog output electronics is isolated as a group together with the RS485 Serial link communication. When using both connections, verify that Analog out user (or RS485 user) is using isolated circuitry.
Twisted and Shielded cable must be used for all analog outputs. Shield should be connected to Chassis Ground externally, near the MPS6.

MPS6-C Discrete Inputs:

The MPS6 incorporates 2 digital (discrete) inputs. The inputs are fully programmable.
For setting possibilities, please see MPS6-C discrete input settings.
Input A..... 31
Input B..... 32
Common..... 37

MPS6-C Discrete Inputs:

The MPS6 incorporates 6 digital (discrete) inputs. The inputs are fully programmable.
Input A..... **31**
Input B..... **32**
Input C..... **33**
Input D..... **34**
Input E..... **35**
Input F..... **36**
Common..... **37**

To turn ON an input connect control voltage between it's terminal and the common terminal 37.

Possible settings:

Start-A (N.O) – Close the contact to operate contactor A. Maintained or Momentary contacts can be used. Open contact overrides any other inputs and force stop condition.

Start-B (N.O) – Close the contact to operate contactor B. Maintained or Momentary contacts can be used. Used for low speed of two speed motor and for reversing applications.

.

Stop (N.C) – Open the contact to stop the motor. Maintained or Momentary contacts can be used.
Note: Open contact override any other inputs or serial linl command and force stop condition.

Interlock N.O – Locks out and prevents operation when closed. Overrides both hardwire and serial link start commands. Open - To enable operation. Permits additional systems interlocking.

Interlock N.C – Locks out and prevents operation when open. Overrides both hardwire and serial link start commands. Close - To enable operation. Permits additional systems interlocking.

Contactor-A N.O – Used as a feedback for contactor A N.O contact status.

Contactor-A N.C – Used as a feedback for contactor A N.C contact status.

Contactor-B N.O – Used as a feedback for contactor B N.O contact status.

Contactor-B N.C – used as a feedback for contactor B N.C contact status.

Remote Reset (N.O) – Close the contact Momentarily to Reset.

Authorized Switch (N.O) – Turn ON to become “Authorized key holder”. A key holder may change setting parameters and use test feature. It is possible to become an “authorized key holder) by software only without using an input contact.

Low Speed N.O of two speed motor – Turn On to indicate Low Speed of two speed motor.

Low Speed N.C of two speed motor – Turn Off to indicate Low Speed of two speed motor.

Emergency Restart (N.O) – Turn On to reset thermal capacity while motor is stopped. Used to allow starting of a hot motor. Applicable for a fire extinguisher pump.

External FAULT 1 N.O – Turn On to cause a fault.

External FAULT 1 N.C – Turn Off to cause a fault.

External FAULT 2 N.O – Turn On to cause a fault.

External FAULT 2 N.C – Turn Off to cause a fault.

Output Relays

The MPS6 incorporates six output relays. The first four relays A,B,C,D rated 5A / 250 VAC resistive, 750VA. The relays are of the normally open type and share one common terminal. Relays E and F are of the Change Over (form C) type, rated 8 A / 250 VAC resistive, 1800 VA inductive. All terminals of the two relays are available.
Each one of the relays can be configured as an:

Contactor A – Set when the relay is used to control operation of Contactor A.
According to the ***Starting Method*** *setting*, the relay *c*an be configured for:
* DOL starting
* Star period of Star-Delta starting
* Forward of a forward-reverse motor
* High speed of two-speed motor

Contactor B – Set when the relay is used to control operation of Contactor B.
According to the ***Starting Method*** *setting*, the relay *c*an be configured for:
* Delta period of Star/Delta starting
* Reverse of a forward-reverse motor
* Low speed of two-speed motor

Start / Run – The output contact turns ON when motor is started or running.
According to the ***Starting Method*** *setting*, the relay *c*an be used to control the line contactor in Star-Delta starters.

Running – The output contact turns ON when motor is running.

Contactor A N.O – The output contact is used to reflect the status of Contactor A. Turns ON if at least one discrete input is declared as Contactor-A N.O and is closed.

Contactor B N.O – The output contact is used to reflect the status of Contactor B. Turns ON if at least one discrete input is declared as Contactor-B N.O and is closed.

Ready – The output Contact is closed when motor is already starting/running or when conditions allow starting. Conditions are :
1.No active Trip,
2. Interlock input(s) are in normal (not locked) position,
3. Stop switch is closed
4. U/V Start Prevent is set to OFF or it is set to ON and voltage is above U/V Start Prevent level.
5. MPS6 is not in Protection Only mode.

U/V Start Prevent – The output relay is turned ON if U/V Start Prevent is not set to OFF and the voltage is lower then the set value. Designed to be used in Protection Only mode to prevent starting of the motor. Relay contact should be connected in series with the motor contactor.

KWH Pulse Relay – The output contact is pulsed once, for 0.4Sec, every KWH as set by KWH PER PULSE.

Alarm – The output contact turns ON upon an alarm. Otherwise it is in the OFF position.

Alarm-Fail Safe – The output contact turns OFF upon an Alarm. Otherwise it is in the ON position.
Note: When a relay is configured for Fail Safe operation, relay is energized when MPS6 is powered and de-energized upon Alarm. Alarm fail-safe, alarms constantly when the unit is not powered.

Trip – The output contact turns ON upon a Trip. Otherwise it is in the OFF position.

Trip-Fail Safe – The output contact turns OFF upon a Trip. Otherwise it is in the ON position.

Fault (or of Alarm and Trip) – Fault condition is an “or” function of Alarm and Trip. The output contact turns ON upon a Fault. Otherwise it is in the OFF position.

Fault-Fail safe – The output contact turns OFF upon a Fault. Otherwise it is in the ON position.

Tripping/Alarm – Relay operates by group of faults as set in Tripping/Alarm page.

 # starts pre alarm – The relay is energized if motor is stopped, as long as a new start would cause Too Many Starts fault. It can be used to prevent the next start as long as it is not allowed.

(I > 0) after Trip – The relay is used as an indication that in spite of a trip, the relay still "see" currents. Can be as a result of a welded contactor.

Output Relay A: **11**
Output Relay B: **12**
Output Relay C: **13**
Output Relay D: **14**
Common of relays A,B,C,D **15**
Output Relay E:
N.C: ..... **16&17**
N.O: ..... **16&18**
Output Relay F:
N.C: ..... **19&20**
N.O: ..... **19&21**

Note: When a relay is configured for Fail Safe operation, relay is energized when MPS6 is powered and de-energized upon fault. It is recommended to assign one relay as an Alarm-Fail safe, to alarm constantly when the unit is not powered.

Rear Serial Link

Standard RS485 Half Duplex, with MODBUS protocol.
Twisted shielded pair should be used for wiring. Shield should be connected to Chassis Ground externally, near the MPS6.
Acceptable baud rates: 1200, 2400, 4800, 9600 and 19200 BPS.
Serial Port (+) **53**
Serial Port (-) **52**

Note: Connect 120 Ohm resistors between (+) and (-) at the end and at the beginning of the line.

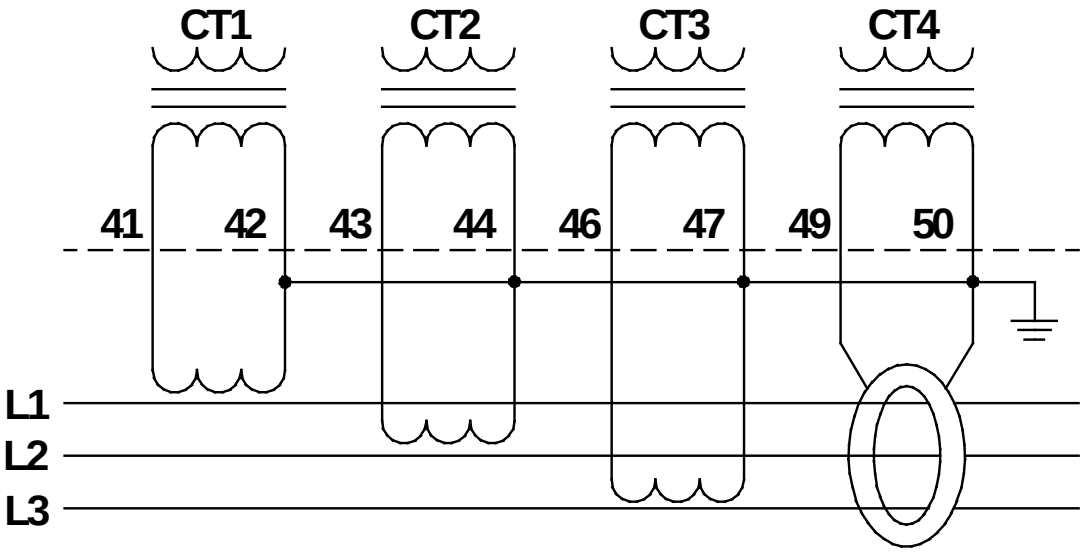
Front Serial Link

Standard RS232, with MODBUS RTU protocol.
Twisted shielded pair should be used for wiring. Shield should be connected to Chassis Ground externally, near the MPS6.
Acceptable baud rates: 1200, 2400, 4800, 9600 and 19200 BPS.
9 pin D Type female connector is used:
RxD Input ..... 2 (of front panel D type connector)
TxD Output ..... 3 (of front panel D type connector)

"C/T" WIRING DIAGRAMS

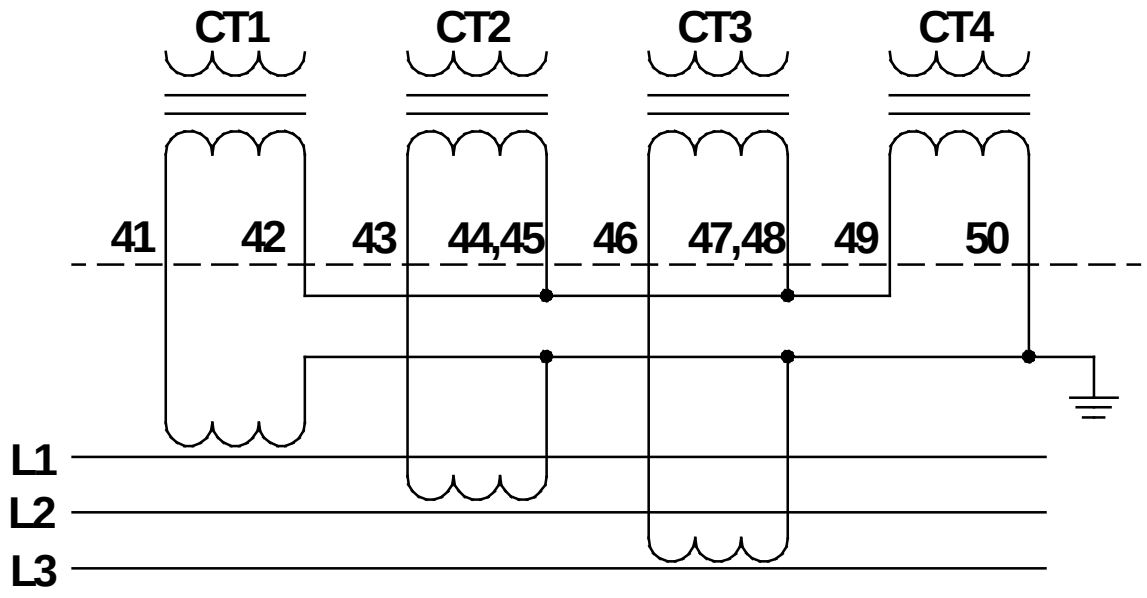
Three "C/T"s + Ground Fault Core Balance "C/T"

It is the preferred connection. It drawback is that a relatively large Core Balance transformer is required.
In this diagram terminal 49, which is the Ground Fault input current gets the sum of the three phase currents. If there is no ground fault leakage current in the motor or cables, this current equals 0.



Three "C/T's" in a Residual Ground Fault Connection

When Core Balance "C/T" is not used and ground fault protection is required, use the residual Ground Fault Connection.
In this diagram terminal 49, which is the Ground Fault input current, receives the sum of the "C/T" outputs of the phase currents.
Ideally, if there is no ground fault leakage current, this current equals 0. Since "C/T"s may saturate slightly during starting, their sum may not be 0 even when there is no leakage current to ground in the motor (or cables).
Note: In System Parameter page, the G/F DURING START setting parameter, is designed to significantly increase the G/F level, during starting (same level for alarm and for trip) to prevent nuisance alarming and / or tripping.
For Residual Connection, It is recommended to leave the value in its default value, which is 100% of FLC**.**



FRONT PANEL OVERVIEW

LEDs and LCD

On - Illuminates when control power supply is connected.

Start/ Run - Flashes during starting, illuminates continuously after completion of starting

Alarm /Trip - Flashes in Alarm condition, illuminates continuously at Trip condition . Turns off after resetting.

LCD Display – Illuminated two lines of 16 characters each, presenting all data and messages.

Operation

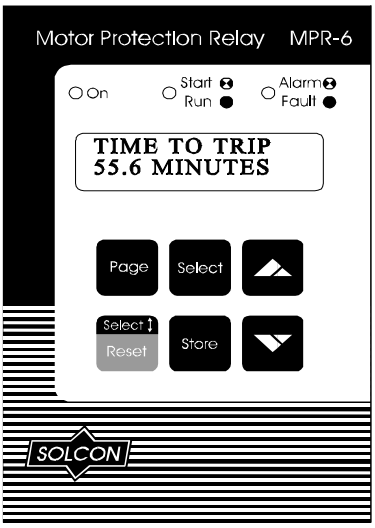
Push **Page** few times until following screen is displayed.
In order to review above page press **Select** key.
Messages are displayed on the LCD in two lines.

- Upper line describes parameter's name.
- Lower line shows its value.

System Parameters
Settings

To change settings, press
▲ or ▼ keys and save the new value by pressing **Store** key.
Once data was properly stored in the non-volatile memory the LCD displays the 2 sec. flash message:

DATA SAVED OK



Notes :

1. A new parameter setting becomes effective only after storing it in the non-volatile memory. Setting a parameter without storing, and moving to another page, will return the parameter to its previously stored value.
2. Any set-point parameter can be viewed, altered and stored at any time (provided that Parameters Lock set to No). However, it is not recommended to change and store parameters while motor is starting or running.
3. Any stored parameter is kept indefinitely in the non-volatile memory.

FRONT PANEL OVERVIEW

Keys

Page - Press to change set-point pages in positive cyclical order.

Select - Press to scroll parameters within page. If key is pressed for more than 0.5 sec, parameters will be displayed at a fast rate.

 - Press to increase / decrease parameter value. Press and hold to fast rate changing (*).

Store - Press to store displayed parameter value in the non-volatile memory (*).

Reset - Press for more then 0.5 Sec. to cancel displayed Alarm or Trip (*).

Short press on the RESET key will toggle the direction of massage display. At up direction a " __ " character is displayed at the bottom left hand side of the LCD.
Pressing on Page key or leaving the keypad with no action for 10 Sec returns scroll direction to forward (down) direction.

Notes:
If "Parameters Lock" is set to Yes, parameters can be only viewed. When Parameters lock is set to No, it is possible to view, change and store any setting parameter.

FRONT PANEL SETTINGS

Startup

On startup the following occurs: **ON** and **Stopped** LED's are turned on
The LCD will display:

System Parameter *** Settings ***

In order to review above page settings, press **Select** key.

Messages are displayed on the LCD in two lines.
* Upper line describes the parameter's name.
* Lower line shows its value.

When **Authorized key** terminals are open, it is possible to view parameters but not to change or store them. An attempt to change a value by ▲, ▼ or to store will result in "Unauthorized Access" message.

To change settings, when **Authorized key** is closed, press ▲ or ▼ keys and save the new value by pressing **Store** key. Once data was properly stored in the non-volatile memory the LCD displays the 2 Sec. flash message:

Data Saved OK

Notes:

1. A new parameter setting becomes effective only **after** storing it in the non-volatile memory. Setting a parameter, without storing, and moving to another page then back to this page, will return the parameter to its previously stored value.

2. Any ***"set page"*** parameters can be viewed, altered and stored at any time. However, it is not recommended to change and store important parameters while the motor is starting or running.

3. Any stored parameter is kept indefinitely in the non-volatile memory.

Reset to Factory Default Values:

Press Set Page key and ▲key simultaneously, the LCD will display:

Test/Maintenance *** Options ***

Press **Select.** key three times, the LCD will display:

Store Now ? Default Settings

Press **Store** and **Set Page** keys simultaneously, the LCD will display:

Data Saved OK

Note: Storing Default parameters erases all previously updated parameters

MESSAGES

Blinking Messages

Blinking messages are displayed as a response to an event. For example:

Data Saved OK

The message is displayed for a short while (2 seconds) only. Display then returns to the previous message.

Blinking messages are usually displayed as a response to an operator action.

It is used either to confirm activation of the requested operation, or to indicate reason for not doing so.

The blinking messages are:

Display	Description
Data Saved OK	Displayed after pressing **Store** key. If an error is found during store process, then next message is shown.
Storage Error	Displayed when an error is found in the store process.
Wrong Parameters	Displayed after power-up, if the non-volatile parameter check sum is found to be wrong.
Unauthorized Access	When Authorized Key is open (locked), and a parameter change is attempted. Also displayed after Unauthorized Store and Reset action.
Unable to Start External interlock	• Displayed if Start is pressed but starting was not initiated because External Interlock locks out and prevents start/run.. • Similar "Unable to Start" with another second line massage may appear specifying the real cause of the "Unable to Start". • Possible reasons: • Stop input is open (= stop). • *"U/V Start Prevent"*, prevents starting due to low voltage. • A trip is active. • External interlock (closed N.O. or open N.C) is locked out. • Protection only is set to "Yes". • Other reasons will cause "Check systems" massage to appear in the second line.
Self Test Passed	Displayed as a response to running the built in test procedure, provided that all tests were "O.K.".
Self Test Failed	Displayed as a response to finding an error

Error Code = 32	during the operation of Test procedure. In case of test failure, reset and test again. If problem persists then Error Code should be reported to Authorized Factory representative.

CONSTANT MESSAGES

Constant messages are displayed upon a fault. Example:

```
TRIP:
MAX START TIME
```

Notes:

1. Pressing **Store** key while the LCD displays a "Data Page" parameter, will store this parameter as the default display. If no key is pressed for more than five minutes, then this parameter becomes the default display parameter. Same is correct for a Set Page header (first message of the page) display.

Constant messages are displayed, as a response to an event and not as a result of an operator action.

Display	Description
Alarm: U/C level 1	Displayed when the Alarm LED illuminates. The lower line displays the Alarm name.
Trip: U/C Level 2	Displayed when the Trip LED illuminates. The lower line displays the Trip name.

MENU NAVIGATION TOP

Parameter Settings

For parameter setting there are five menu options available.

By pressing **Set Page** key the LCD presents the following menus:

System Parameter *** Settings ***	Overload *** Settings ***	I/O parameters *** Settings ***
Voltage *** Settings ***	Power *** Settings ***	Tripping / Alarm *** Options ***
Current *** Settings ***	Temperature *** Settings ***	Communication *** Settings ***

Data Review

By pressing **Data Page** key the LCD displays the following headers:

Measured Data - **** -	Statistical Data - **** -
Calculated Data - **** -	Fault Data - **** -

Test / Maintenance

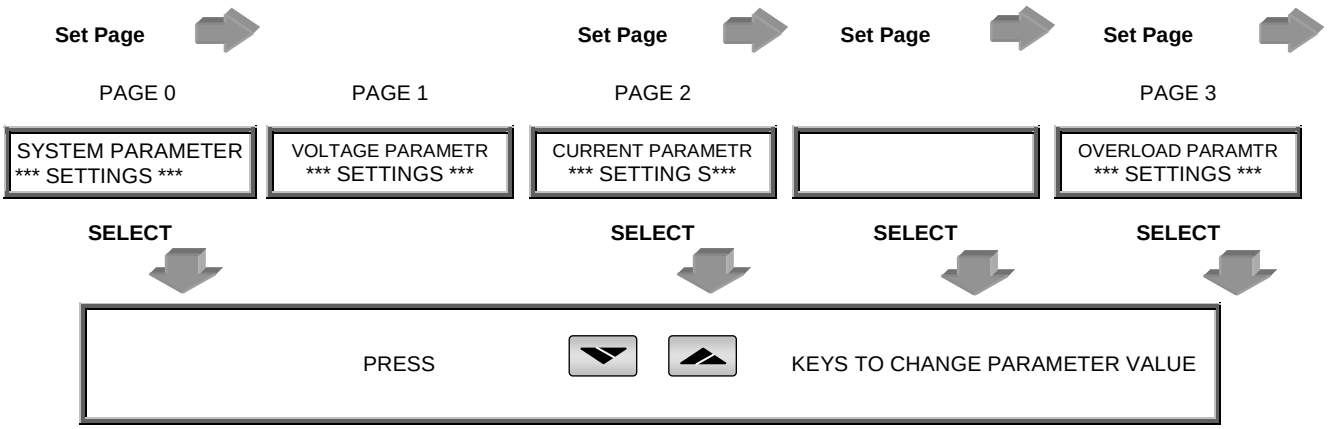
By pressing **Set Page** key and ▲key simultaneously, the LCD will display:

Test/Maintenance *** Options ***

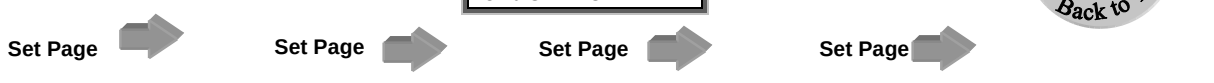
MENU

Below the menu navigation structure and MPS6 default parameter settings.

Navigation



LINE VOLTS (Vn) 400V	U/V LEVEL 80% OF Vn	MAX START TIME 10 SEC.	UNBALANCE MIN T 5 SEC.	CURVE MULTIPLIER 6
LINE FREQUENCY 50Hz	U/V DELAY 5.0 SEC.	NUMBER OF STARTS 10	U/B LVL 2 MAX T 30 SEC.	OVERLOAD PICKUP 105 % OF FLC
MOTOR FLC 100 AMP.	UV ACTIVE AT STOP DISABLE	STARTS PERIOD 30 MIN.	GND FAULT LVL 1 5% OF FLC	HOT/COLD RATIO 50 %
CT PRIMARY 100 AMP.	U/V STRT PREVENT OFF	START INHIBIT 15 MIN.	G/F LVL 1 DELAY 10 SEC.	RUN COOL T CONST 10 MIN.
GND CT PRIMARY 100 AMP.	U/V AUTO RESTART DISABLE	U/C LEVEL 1 50 % OF FLC	GND FAULT LVL 2 10% OF FLC	STP COOL T CONST 30 MIN.
CURRENT INHIBIT OFF	U/V RESTRT DELAY	U/C LEVEL 1 DELAY 2 SEC.	G/F LVL 2 DELAY 0.5 SEC.	UNBALANCE K FCTR 5
STARTING METHOD DIRECT ON LINE	O/V LEVEL 1 115 % OF Vn	U/C LEVEL 2 40 % OF FLC	G/F DURING START 100% OF FLC	RTD BIAS OFF
MAX TIME IN STAR	O/V LEVEL 2 120 % OF Vn	U/C LEVEL 2 DELAY 5 SEC.	UNSTABLE CURRENT 5% OF FLC	RTD BIAS MINIMUM 40 °C
TRANSITION TIME	O/V LEVEL 2 DELAY 1 SEC.	LOAD INCREASE 120 % OF FLC		RTD BIAS MIDDLE 130 °C
STAR TO DELTA AT		O/C LEVEL 1 – JAM 400 % OF FLC		RTD BIAS MAXIMUM 155 °C
PROTECTION ONLY YES		O/C LEVEL 1 DELAY 2.0 SEC.		THERMAL LEVEL 1 80 % OF CAPACITY
DISPLAY MODE FULL DISPLAY		O/C LEVEL 2– SHORT 800 % OF FLC		
		O/C LEVEL 2 DELAY 0.5 SEC.		
		UNBALANCE LEVEL 2 15 % OF FLC		



Back to Top

MENU

PAGE 4	PAGE 5	PAGE 6	PAGE 7	PAGE 8
POWER PARAMETERS *** SETTINGS ***	TEMPERATURE PAR. *** SETTINGS ***	I/O PARAMETERS *** SETTINGS ***	TRIPPING / ALARM *** OPTIONS ***	COMMUNICATION P. *** SETTINGS ***
SELECT	**SELECT**	**SELECT**	**SELECT**	**SELECT**

PRESS   KEYS TO CHANGE PARAMETER VALUE

RATED PF AT FLC 0.88 LAG	CH. 1 2 3 SENSOR PT100	CONGIG. INPUT A START A SWITCH	MAX START TIME TRIP: DISABLE	BAUD RATE 19200
UNDER PWR LEVEL 1 45%	T1 LEVEL 1 120 EC	CONGIG. INPUT B STOP SWITCH	MAX START TIME ALARM: ENABLE	ADDRESS NUMBER 248
U/P LEVEL 1 DELAY 30 SEC.	T1 LEVEL 2 140 EC	CONGIG. INPUT C INTERLOCK N.C.	MAX START TIME AUTO RST: DSABL	S.LINK SAVE LOCK LOCKED
UNDER PWR LEVEL 2 25%	T2 LEVEL 1 120 EC	CONGIG. INPUT D CONTACTOR A N.O	MAX START TIME PANEL RST: ENABL	20 MODBUS # for user group of data.
U/P LEVEL 2 DELAY 30 SEC.	T2 LEVEL 2 120 EC	CONGIG. INPUT E EXT FAULT 1 N.O.	MAX START TIME REMOT RST: ENABL	
LOW POWER FACTOR 0.8 LAG	T3 LEVEL 1 80 EC	CONGIG. INPUT F EXT FAULT 2 N.O.	MAX START TIME OUTPUT A: DISABL	
LOW PF DELAY 30 SEC.	T3 LEVEL 2 100 EC	PARAM. SETTINGS NOT LOCKED	MAX START TIME OUTPUT B: DISABL	
KWH PER PULSE OFF		CONFIG. OUTPUT A CONTACTOR A	MAX START TIME OUTPUT C: DISABL	
		OUTPUT DELAY 0 SEC.	Similar settings for next 50 Fault protections	
		CONFIG. OUTPUT B FAULT		
		OUTPUT DELAY 0 SEC.		
		CONFIG. OUTPUT C READY	CONFIG. OUTPUT F TRIP	
		OUTPUT DELAY 0 SEC.	OUTPUT DELAY 0 SEC.	
		CONFIG. OUTPUT D RUNNING	ANALOG OUT TYPE 4..20 mA	
		OUTPUT DELAY 0 SEC.	ANLOG OUT PARAM. POWER	
		CONFIG. OUTPUT E ALARM- FAIL SAFE	ANLOG OUT MIN. 0 % OF Pn	
		OUTPUT DELAY 0 SEC.	ANLOG OUT MAX. 200 % OF Pn	

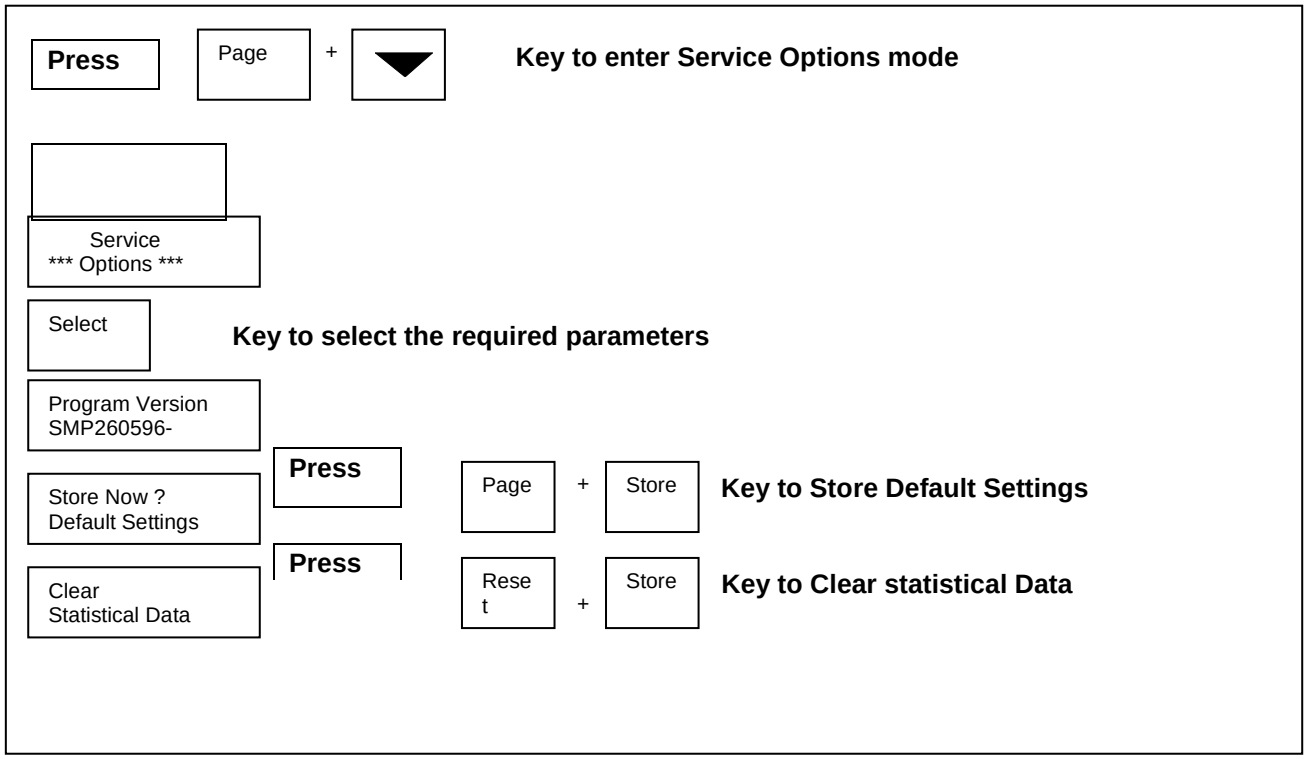
→

Data Page  **Data Page**  **Data Page**  **Data Page** 

MENU

Data Page →	Data Page	Data Page →	Data Page →
PAGE 10	PAGE 11	PAGE 12	PAGE 13
MEASURED DATA - **** -	CALCULATED DATA - **** -	STATISTICAL DATA - **** -	FAULT DATA - **** -
SELECT	**SELECT**	**SELECT**	**SELECT**
VP VL 230 400 V	MOTOR LOAD CURR. 96 % OF FLC	TOTAL RUN TIME 9857 HOURS	LAST TRIP EXTERNAL FAULT 1
I1 I2 I3 100 101 100 A	EQUIVALENT CURR. 97 % OF FLC	TOTAL # OF START 410	LAST ALARM MAX START TIME
GROUND CURRENT 0 AMP.	UNBALANCE CURR. 5 %	TOTAL # OF TRIPS 7	TRIP I1, I2, I3 431 435 432 A
FREQUENCY 50.0 Hz	THERMAL CAPACITY 48 % OF CAPACITY	LAST STRT PERIOD 9.8 SEC.	TRIP GND CURRENT 0 AMP.
POWER 55.2 KW	TIME TO TRIP O/L NO TRIP EXPECTED	LAST START MAX I 760 AMP.	TRIP VOLTAGE 230 V
REACTIVE POWER 38.3 KVAR	TIME TO START 0 SEC.	TOTAL ENERGY 457,235 KWH	LAST 10 TRIPS:
POWER FACTOR 0.86		TOTAL REACT. EN. 265,107 KVARH	EXTERNAL FAULT 1 08:32 08/05/02
T1 T2 T3 105 104 105 °C	Back to Top	MINUMUM VOLTAGE 395 VOLT	T1 LEVEL 2 13:33 06/13/02
IN # 1 2 3 4 5 6 0 1 1 1 0 0		MAXUMUM VOLTAGE 404 VOLT	O / C LEVEL 2–SHORT 11:26 03/21/02
OUT#1 2 3 4 5 6 1 0 1 1 1 0		MINIMUM CURRENT 73 AMP.	Similar messages of previous 7 trips.
Back to Top		MAXIMUM CURRENT 86 AMP.	
		MIN. FREQUENCY 49.9 Hz	
		MAX. FREQUENCY 50.1Hz	
		Back to Top	

Service Page



SET PAGE - MENUS

These menus are accessed by pushing the SET PAGE button.

System Parameters

System Parameter
*** Settings ***

Display	Description
Line Volts (Vn) 480 Volt	Rated Line to Line Mains Voltage. Range: 100V-690V. Increments: 1V
Line Frequency 60 Hz	Rated Mains Frequency. Range: 50, 60 Hz
Motor FLC 100 Amp.	Motor Full Load (rated) Current. Range: 1 - 2000A. Increments: 1A
"C/T" Primary 100 Amp.	Primary rated current of Current Transformer. (No need to set Secondary rated current). Range: 1 - 2000A. Increments: 1A
GND "C/T" Primary 100 Amp.	Primary rated current of Ground Fault Transformer. (No need to set Secondary rated current). Range: 1 - 2000A. Increments: 1A
Current Inhibit OFF	Prevents trip and inhibits opening of contactors A & B, when short circuit current exceeds the set value, to prevent contactor's damage. Thermal trip overrides current inhibit. Set to OFF when contactors are not used to trip the motor (for circuit breaker application). **WARNING**: The MPS will not protect the motor against high current above the current inhibit setting. It is the customers responsibility to ensure that the motor is protected against fault current, above Current Inhibit by external protection Range: OFF, 400-1000% of Motor FLC. Increments:10%.
Starting Method Direct on Line	Type of starting method. Range: Direct on Line, Star (Wye)/Delta, Reversing, Two-speed and No Start Process. Use No Start Process setting, to allow entering to run even if current at “starting” is low (for example for transformer protection).

When selecting and storing Star-Delta method, the following three parameters values can be altered.

Max. Time in Star 10 Sec.	Time period during which star contactor is closed. This time will shorten if current decreases below "Star to Delta at" value, but not below 0.25 Max Time in Star. Range: 1- 60 Sec. Increments: 0.1 Sec.
Transition Time 200 ms.	Time period when both contactors A and B are open. range: 0.05 - 2 Sec. Increments: 0.05 Sec.
Star to Delta at 150% of FLC	Current value (in % of FLC) in which Star to Delta switching occurs. Provided Star time is above 25% of "Max Time in Star" setting. Range: 70 - 200% of FLC. Increments: 1%

System Parameter
*** Settings ***

Display	Description
Line Volts (Vn) 480 Volt	Rated Line to Line Mains Voltage. Range: 100V-690V. Increments: 1V
Line Frequency 60 Hz	Rated Mains Frequency. Range: 50, 60 Hz
Motor FLC 100 Amp.	Motor Full Load (rated) Current. Range: 1 - 2000A. Increments: 1A
"C/T" Primary 100 Amp.	Primary rated current of Current Transformer. (No need to set Secondary rated current). Range: 1 - 2000A. Increments: 1A
GND "C/T" Primary 100 Amp.	Primary rated current of Ground Fault Transformer. (No need to set Secondary rated current). Range: 1 - 2000A. Increments: 1A
Current Inhibit OFF	Prevents trip and inhibits opening of contactors A & B, when short circuit current exceeds the set value, to prevent contactor's damage. Thermal trip overrides current inhibit. Set to OFF when contactors are not used to trip the motor (for circuit breaker application). **WARNING**: The MPS will not protect the motor against high current above the current inhibit setting. It is the customers responsibility to ensure that the motor is protected against fault current, above Current Inhibit by external protection Range: OFF, 400-1000% of Motor FLC. Increments:10%.

When selecting and storing "Direct On Line" or "Reversing", none of the above parameters can be altered.
When selecting and storing "Two Speed" method, the following two parameters can be altered.

Low Speed FLC. 10 Amp.	Low speed motor FLC. Range: 1 - 2000 Amp. Increments: 1A
Lo Spd Curve Mul 15	Overload Trip Curve Multiplier. Note: Set to 1..15 !! Range: 1 - 15. Increments: 1.
Star to Delta at	Can not be altered.

Display Mode Full Display	Enables to see all screens or few less. Range: Full Display, Less Display, Minimum Display, User
Protection Only Yes	Determines MPS operation mode: Protection & Control (No) Protection Only (Yes) Range: Yes, No

Voltage Settings

Voltage Parametr
*** Settings ***

Display	Description
U/V Level 80% of Vn	Under Voltage level, (in % of nominal voltage). Fault occurs when voltage is below set value for more than U/V delay. Range: 50 - 95 % of Vn. Increments: 1 %
U/V Delay 5.0 Sec.	Under Voltage time delay. Range: 0.2 - 10 Sec. Increments: 0.1 Sec.
UV Active at Stop Disable.	Determines if Under Voltage protection is active at stop. If disabled, u/v is active only if not at stop. Range: Disable, Enable
U/V Strt Prevent OFF	Prevents starting if mains voltage is lower than set by U/V Start Prevent. For MPS6-C only. Range: OFF, 51-95 % of Vn. Increments: 1%
U/V Auto Restart Disable	Enables / Disables the auto Restart features. • Set to "Disable", if Restart is not required. • Set to "Measured Voltage", if control power supply (at terminals 2-3) is stable during mains failure (powered from UPS or DC). Mains Failure is detected and causes motor stop, when voltage decreases below 65% of rated voltage. Mains restoration is detected when voltage increases to above 85% of rated voltage. • Set to "Both Sup & Vin" for normal AC mains (both measured voltage (at terminals 5,7) and control power supply (at terminals 2,3) turn off during mains failure). Note: Setting as "Auxiliary Supply" may not cause restart, for mains failure duration of less than 0.5sec. Restart occurs only if: • Motor was Starting/Running before mains failure • Turn off time is 0.1 - 4 sec. (±25%) • Normal start conditions are met (Stop and Interlock are not active). • Voltage level is enough for starting (restored to above "***U/V Strt Prevent***").

	Range: Disable, Auxiliary Supply, Measured Voltage, Both Sup. & Vin
U/V Restart Delay 4 Sec.	Time delay for the auto Restart feature, counted from mains (auxiliary supply or measured voltage, as set on u/v Start Prevent) restoration Range: 0.4 – 25 Sec.
O/V Level 1 115% of Vn	Over Voltage Level 1. Fault occurs when voltage is above set value for more than 1 second (fixed delay). Range: 100 - 120 % of Un. Increments: 1%
O/V Level 2 120% of Vn	Over Voltage Level 2. Fault occurs when voltage is above set value for more than O/V LEVEL 2 Delay. Range: 100 - 120 % of Un. Increments: 1%
O/V Level 2 Delay 1 Sec.	Over Voltage Level 2 delays. Range: 1 - 100 Sec. Increments: 1Sec.

Current Settings

Current Parametr
*** Settings ***

Display	Description
Max Start Time 10 Sec.	Maximum Permitted starting time until current is reduced to 110% of Overload Pickup setting parameter. Protects the motor against too long starting. Range: 1 – 250 Sec. Increments: 1 Sec.
Number of Starts 10	Maximum Permitted number of starts during "Starts Period". Range: 1 – 10. Increments: 1
Starts Period 30 min.	Time period during which the number of starts is counted. Range: 1 - 60 min. Increments: 1 min.
Start Inhibit 15 min.	Time period after which auto reset is prevented (even if enabled) after "Too Many Starts" trip. Range: 1 - 60 min. Increments:1 min.
U/C Level 1 50% of FLC	Under Current Level 1. Fault occurs when current is below the set parameter for more than U/C Level 1 Delay. Range: 10 - 90 % of Motor FLC. Increments: 1%
U/C Level 1 Delay 2 Sec.	Under Current Level 1 Delay. Range: 1 - 60 Sec. Increments: 1 Sec.
U/C Level 2 40% of FLC	Under Current Level 2. Range: 10 - 90 % of Motor FLC. Increments: 1%
U/C Level 2 Delay 5 Sec.	Under Current Level 2 Delay. Range: 1 - 60 Sec. Increments: 1 Sec.
Load Increase 120% of FLC	Load Increase, is normally intended for alarm. Operative after start process ended (after current decreased below 110% of Overload pickup). Fault occurs when the average of the three phase RMS currents is above the set parameter for more than fixed time period of 5 seconds. Range: 60 - 150% of Motor FLC. Increments: 1%
O/C Level 1- Jam 400 % of FLC	Over Current Level 1- Jam (stall) protection. Operative after start process ended. Indicates that the average of the three phase RMS currents exceeded set value for more than ***O/C Level 1 Delay***. Range: 100 - 500 % of Motor FLC. Increments: 10%
O/C Level 1 Delay 2.0 Sec.	Time delay for O/C Level 1. Range: 0.5 - 10 Sec. Increments: 0.1 Sec.
	Over Current Level 2- Short circuit protection. Operative during starting and

O/C Level 2- Short
800 % of FLC

running. Indicates that largest of the three phase currents exceeded set value for more than ***O/C Level 2 Delay***.

Note: O/C Level 2" Trip is prevented, when the highest of any of the line currents exceeds **Current Inhibit** setting.
It is designed to prevent opening of motor contactor under high short circuit conditions to protect it's contacts from being damaged.

Range: 400 - 1200 % of Motor FLC. Increments: 10%

O/C Level 2 Delay
0.5 Sec.

Time delay for Over Current Level 2

Note: When set to 0, actual delay is less than 70mSec.

Range: 0 - 4 Sec. Increments: 0.1 Sec.

Unbalance Level 2
15 % of FLC

Unbalance Current. Fault occurs only if actual Unbalance is greater than the set value. See Figure 6 for time delay.

Note - Unbalance Current level 1 will be activated when Unbalance Current exceeds 50% of the Unbalance Level 2 for more than 1 second (fixed time period).

Range: 10 - 40 % of Motor FLC. Increments: 1%

Unbalance Min T
5 Sec.

Unbalance Minimum response time for both Alarm and Trip.

Range: 1 - 30 Sec. Increments: 1 Sec.

U/B Level 2 Max T
30 Sec.

Unbalance curve selection. see p37

Time delay at 10% of Unbalance. Fault time is inversely related to the actual unbalance (See page 37).

Range: 20 - 120 Sec. Increments: 1 Sec.

GND Fault Level 1
5% of FLC

Ground Fault current initiating a Level 1 Alarm / Trip (in % of Motor FLC), after G/F Level 1 Delay. This setting has no effect during starting. See G/F During Start parameter.
Range: 1 – 100% of FLC. Increments: 1%

G/F Level 1 Delay
10 Sec.

Ground Fault Level 1 Alarm / Trip Delay.
Range: 1 - 60 Sec. Increments: 1 Sec.

GND Fault Level 2
10% of FLC

Ground Fault current initiating Level 2 Alarm / Trip (in % of Motor FLC),after G/F Level 2 Delay. This setting has no effect during starting. See G/F During Start parameter.
Range: 1-100% of Motor FLC. Increments: 1 %.

G/F Level 2 Delay
0.5 Sec.

Ground Fault Level 2 Alarm / Trip Delay.
Range: 0 - 2 Sec. Increments: 0.1 Sec.

G/F During Start
100% of FLC

Ground Fault Level 1 & 2 Alarm / Trip During start period. Intended to be used with Residual "C/T"s connection, to prevent nuisance tripping with high currents of start process.
Range: 1 – 100% of FLC. Increments:1 %.

Overload Settings

Overload Parametr
*** Settings ***

Display	Description
Curve Multiplier 6	Overload Curve Multiplier. Shifts the entire Overload Curve. Range: 1 - 15. Increments: 1.
Overload Pickup 105% of FLC	Lower threshold for O/L protection. Below this threshold, O/L fault cannot occur. Range: 60 - 130 % of Motor FLC. Increments: 1%
Hot/Cold Ratio 50%	The ratio between thermal Capacity available for starting a hot motor and thermal capacity available for starting a cold motor. (A higher setting allows for a longer starting time of hot motor before tripping). Range: 20- 100% of Thermal Capacity. Increments:1%.
Run Cool T Const 10 min.	Cooling Time Constant while motor is running. When Current is smaller than Overload Pickup, Thermal Capacity is exponentially reduced to simulate motor cooling to (100-Hot/Cold ratio) Range: 1 – 240 min. Increments:1min.
Stp Cool T Const 30 min.	Cooling Time Constant while motor is stopped. This time constant is normally significantly longer than the Cooling Time Constant of a running motor. Range: 1 – 240 min. Increments:1min.
Unbalance K Fctr 5	Unbalance K Factor. Used to increase the motor's equivalent current as a result of Unbalance currents. The Unbalance currents cause a negative Sequence Currents. The MPS6 measures the Negative as well as positive sequence currents and uses their values to calculate the equivalent current, given by: $LEQ = I\% * \sqrt{(1 + K * (IN/IP)^2)}$ Where: I% - Motor RMS (average of the three phases) current IN – Negative sequence Current IP – Positive Sequence current Range: 0 – 15. Increments:1
RTD Bias OFF	RTD Bias allows to disable RTD Bias or to use max of RTD1..3 for the temperature bias. Note that when enabled, the RTD BIAS can only increase the Thermal Capacity value. It can never decrease it. Range: OFF, T1..T3
RTD Bias Minimum 40 °C	RTD Minimum is the minimum bias temperature. Below this temperature, the RTD bias has no effect on the thermal model. Range: 10°C..248 RTD Bias Middle. Increment of: 1°C.
RTD Bias Middle 130 °C	Set RTD Middle to the normal expected working temperature with 100% load. At this point, the thermal capacity (at steady state) should be 100 – Hot/Cold ratio. Range: Set inside RTD Minimum…RTD Maximum. Increment of: 1°C.

RTD Bias maximum 155 °C	Set RTD Max to the maximum allowed working temperature. At this point, the thermal capacity should be 100%. Range: RTD Middle…250°C. Increment of: 1°C.
Thermal Level 1 80% of Capacity	Thermal Capacity level 1. Normally used for alarm indication. Range: 50 - 99 % of maximum thermal capacity. Increments: 1%

Power Settings

Power Parameters
*** Settings ***

Display	Description
Rated PF at FLC 0.88 Lag	Motor rated (Nameplate) power factor. Required for calculating rated power (based on motor FLC and line volts). Range: 0.5 – 0.99. Increments : 0.01
Under Pwr Lvl 1 45%	Under power level 1.In percent of rated power, calculated by: √3 * Line Volts * Motor FLC * Rated Power Factor Range: 5 - 99%. Increments: 1%
U/P Lvl 1 Delay 30 Sec.	Under Power Level 1 time delay. Range: 1 - 120 Sec. Increments: 1 Sec.
Under Pwr Lvl 2 25%	Under power level 2, in percent of rated power. Range: 5 - 99%. Increments: 1%
U/P Lvl 2 Delay 30 Sec.	Under Power Level 2 time delay. Range: 1 - 120 Sec. Increments: 1 Sec.
Low Power Factor 0.80 Lag	Low Power factor level. Fault occurs when PF is below the set parameter for more than Low PF Delay. Range: 0.20 - 0.98. Increment of: 0.01
Low PF Delay 30 Sec.	Low Power Factor Delay Range: 1 – 120. Increments: 1
KWH Per Pulse OFF	KWH pulse relay. Set required KWH for each relay pulse. Range: OFF, 1 – 100. Increment of: 1

Temperature Settings

Temperature Par
*** Settings ***

General Note:

Level 1 & 2 Fault Fault occurs when temperature is above the set parameter for more than a fixed time period of 2 seconds

Display	**Description**
CH. 1 2 3 Sensor	Resistance Temperature Detector Type.
PT 100	Range: PT100, PTC thermistor, NTC Thermistor Note: PT100 or thermistor is fixed in production. Can be changed by internal dip switches.
T1 Level 1	RTD No. 1 level 1
120 EC	Range: 50 - 250 EC. Increment: 1 deg.C
T1 Level 2	RTD No. 1 level 2.
140 EC	Range: 50 - 250 EC. Increment: 1 deg.C
T2 Level 1	RTD No. 2 level 1
120 EC	Range: 50 - 250 EC. Increment: 1 deg.C
T2 Level 2	RTD No. 2 level 2
140 EC	Range: 50 - 250 EC. Increment: 1 deg.C
T3 Level 1	RTD No. 3 level 1
120 EC	Range: 50 - 250 EC. Increment: 1 deg.C
T3 Level 2	RTD No. 3 at level 2
140 EC	Range: 50 - 250 EC. Increment: 1 deg.C

I/O Settings

I/O PARAMETERS
*** Settings ***

Display	Description
Config. Input A Start A Switch	Enables Configuration of Discrete Input A as: • Start A Switch – Can be used to start the motor.Can be momentary or maintained. • Start B Switch – Can be used to start the motor in the reverse direction or to start the low speed of two speed motor. Can be momentary or maintained. • Stop Switch – N.C. input. Should be closed to enable start/run. • Contactor A N.C.(for MPS6-C, for sensing contactor A status). • Interlock N.O. – Should be open to allow start/run. • Interlock N.C. – Should be Closed to allow start/run. • Contactor A N.O. – Contactor status from its N.O. auxiliary contact. • Contactor A N.C. – Contactor status from its N.C. auxiliary contact. • Contactor B N.O. – Contactor status from its N.O. auxiliary contact. • Contactor B N.C. – Contactor status from its N.C. auxiliary contact. • Remote Reset. • Authorized Key • Low Speed of Two Speed motor (for different FLC and Thermal Overload Curve). Should be closed at low speed. • High Speed of Two Speed motor (for different FLC and Thermal Overload Curve). Should be closed at high speed. • Emergency Restart (Reset Thermal capacity at stop, Ignore No. Of Starts). • External Fault 1 N.O., close to trip • External Fault 1. N.C., open to trip • External Fault 2 N.O., close to trip • External Fault 2. N.C., open to trip
Config. Input B Stop Switch	Enables Configuration of Discrete Input B. Range: Same as for Config. Input A
Config. Input C Interlock N.C.	Enables Configuration of Discrete Input C. Range: Same as for Config. Input A
Config. Input D Contactor A N.O.	Enables Configuration of Discrete Input D. Range: Same as for Config. Input A
Config. Input E Ext Fault 1 N.O.	Enables Configuration of Discrete Input E. Range: Same as for Config. Input A
Config. Input F Ext Fault 2 N.O.	Enables Configuration of Discrete Input F. Range: Same as for Config. Input A
Param. Settings Locked Out	Can be used instead of external “Authorized Key” input. When set as “Locked Out”, external key options function normally. When set as Not Locked, external key inputs are ignored and MPS is in Authorized condition (same as if external key is connected).

Config. Output A
Contactor A

Enables Configuration of Output A relay as:

- Contactor A (the relay is used for controlling contactor A)
- Contactor B (the relay is used for controlling contactor B)
- Start / Run - Shows that motor is in starting or running mode. Can be used for activating Start/Run (main) contactor of a Star-delta starter.
- Running - Running indication. Relay is activated after motor is started and current is reduced below 110% of Overload Pickup level.
- Contactor A N.O. Relay follows actual contactor A Status. To use, connect contactor A N.O. to Input X and set CONFIG. INPUT X as Contactor A N.O. (X is any input A..F)
- Contactor B N.O. Relay follows actual contactor B Status. To use, connect contactor B N.O. to Input X and set CONFIG. INPUT X as Contactor B N.O. (X is any input A..F)
- Ready - Indicates that the MPS6 is not in protection only mode, there is no active trip, interlock is not locked out, stop input is closed and voltage level is above the preset U/V Start Prevent (can be at OFF). Note: Voltage level is checked only if motor is not already running.
  Under Voltage Start Prevent. Contact can be used to prevent starting if voltage is below ***U/V Start Prevent***.
- KWH Pulse Relay. Relay can be used to pulse every ***KWH Per Pulse*** setting parameter located at the end of Power Parameters page.
- Alarm
- Alarm - Fail Safe
- Trip
- Trip - Fail Safe
- Fault (or of Alarm and Trip)
- Fault-Fail Safe.
- Tripping / Alarm (Relay operates by group of faults as set in Tripping/Alarm page).
  Number Of Starts Pre Alarm. Can be used to prevent starting, as long as it is forbidden to start. Relay is energized after stopping for as long as new start is not allowed. Then it is released.
- (I > 0) After Trip. Relay energizes if the MPS6 still measure current > 10% of rated, after a Trip. Can be used to trip an upstream breaker if contactor is welded.

Output Delay
0 Sec.

Time delay for Output A.
Range: 0 - 250 Sec. Increments: 1 Sec.

Config. Output B
Fault

Enables Configuration of Output B relay.
Range: Same as for Config. Output A.

Output Delay
0 Sec.

Time delay for Output B.
Range: 0 - 250 Sec. Increments: 1 Sec.

Config. Output C
Ready

Enables Configuration of Output C relay as:
Range: Same as for Config. Output A.

Output Delay
0 Sec.

Time delay for Output C.
Range: 0 - 250 Sec. Increments: 1 Sec.

Config. Output D
Running

Enables Configuration of Output D relay as:
Range: Same as for Config. Output A.

Output Delay
0 Sec.

Time delay for Output D.
Range: 0 - 250 Sec. Increments: 1 Sec.

Config. Output E
Alarm-Fail Safe

Enables Configuration of Output E relay as:
Range: Same as for Config. Output A.

Output Delay 0 Sec.	Time delay for Output C. Range: 0 - 250 Sec. Increments: 1 Sec.
Config. Output F Trip	Enables Configuration of Output F relay as: Range: Same as for Config. Output A.
Output Delay 0 Sec.	Time delay for Output D. Range: 0 - 250 Sec. Increments: 1 Sec.
Analog Out Type	Selects type of analog out.
4..20mA	Range: 0..20mA, 4..20mA
Anlog Out Param.	Analog 2 output parameter.
Power	Range: I1,I2,I3,Average Current, Max of (I1,I2,I3),Ground Current, Voltage, Power, Power Factor, Thermal Capacity, Max of T1..T3
Anlog Out Min.	Value for zero (0 or 4mA) output.
0 % of Pn	Range: 0..200 (Units change with parameter).
Anlog Out Max.	Value for maximum (20mA) output.
200 % of Pn	Range: 0..250 (Units change with parameter).

Communication Settings (for convenient this page is shown here, although it is displayed after the Tripping/Alarm page.

Note: Communication settings are shown for Modbus protocol. The MPS6 incorporates two serial links. Rear (main) and Front. Rear communication uses RS485 and Modbus RTU protocol. Please consult factory for other protocols. Front panel is intended for settings or temporary reading actual data, It uses RS232 with Modbus RTU protocol only.

Communication P.
*** Settings ***

Display	Description
Baud Rate 19200	Rear (main) Serial Link communication speed in bps. Disconnect and then reconnect auxiliary supply after any change of baud rate. Range: 1200, 2400, 4800, 9600, 19200 bps.
Address Number OFF	MPS Address of Rear (main) Serial Link. RS485 Allows a maximum of 32 MPS3000s on a twisted pair. Range: 1 - 247, OFF. Increments of: 1
S. Link Par. Save Disable	When set to Disable, prevents setting through any one of the two serial link communication channels. When set to Enable, setting through any of the two serial link channels is enabled. Range: Disable, Enable.
Ser. Link Control Disable	When set to Disable, prevents Start A / Start B / Stop / Reset, through any of the serial link communication channels. When set to Enable, control functions through the serial links are enabled. Range: Disable, Enable.
Front Com Addres OFF	MPS Address of Front Serial Link. The front serial link uses RS232. Range: 1 - 247, OFF. Increments of: 1

Note: It is only possible to write and read through MODBUS communication (only !, parameters cannot be displayed on screen and cannot be changed from keyboard) 20 additional setting parameters. These parameters are numbers of MODBUS actual parameters. By writing to these parameters, user can define a group of up to 20 parameters that can be scanned as one group. See the MPS6 COMMUNICATION Manual for further reference.

Tripping/Alarm Options

Tripping / Alarm
*** Options ***

Tripping Alarm Common Settings

All MPS6 protections share the same settings described below. Accessible via the menu Tripping/Alarm Options.

Area	Function	Setting	Observation
Mode	Trip only	Set Trip: Enable Set Alarm: Disable	Upon Trip: Alarm/Trip LED illuminates. Output X relay: if configured as "Trip", energizes. If configured to "Trip - Fail Safe", de-energizes.
Mode	Alarm only	Set Trip: Disable Set Alarm: Enable	Upon Alarm: Alarm/Trip LED flashes. Output X relay: if configured as "Alarm", energizes. If configured to "Alarm - Fail Safe", de-energizes.
Mode	Alarm and Trip	Set Trip: Enable Set Alarm: Enable	Upon Fault: Alarm/Trip LED illuminates. Output X relay: if configured as "Trip", energizes. If configured to "Trip - Fail Safe", de-energizes. Output Y relay: if configured as "Alarm", energizes. If configured to "Alarm - Fail Safe", de-energizes.
Mode	Disabled	Set Trip: Disable Set Alarm: Disable	Behavior upon Fault The MPS6 completely ignores the fault.
Reset	Auto Reset	Set Auto Rst: Enable. (when not required set to Disable)	The MPS6 resets itself automatically when the fault cause disappears. The Auto Reset is activated after a 2 second delay. It is recommended to always Disable Auto Reset. On some faults, when Auto Reset is enabled, the MPS6 trips and after a 2 Sec. delay resets itself automatically. The fault message on the LCD disappears after 2 Sec. Example: On "U/C Level 1", when Auto Reset function is Enabled, the contactor opens and causes automatic Reset. The motor stops and the "U/C Level 1" message is displayed for only 2 Sec.
Reset	Panel Reset	Set Panel Rst: Enable. (to prevent reset by the the operator, set to Disable)	Activated by the **RESET** key on the MPS6 front panel, only if there is no Start signal (to prevent start as a result of resetting) When Panel resetting is not permitted, set Panel RST: DSABL. For critical faults, such as "Overload" and "Ground Fault", it is a good practice to prevent Panel Resetting by the operator. An authorized person (key holder - few key options are available, according to Discrete input A..E and to Param. Settings) can always reset any fault.
Reset	Remote Reset	Set Remote Reset: Enable	Each one of the six MPS6 Discrete (digital) inputs can be set for Remote Reset.

Area	Function	Setting	Observation
Reset	Reset via serial link.		For MPS6, the reset via serial link is always accepted.
Output Relays	**Enable Relay-X activation upon trip or Alarm**	Set to ENABLE or DISABLE	Output Relay-X can be set to function with: • Trip • Trip-Fail Safe • Alarm • Alarm-Fail Safe • Fault (or of Alarm and Trip) • Fault-Fail Safe Tripping/Alarm. Relay is energized if a Trip or Alarm occurs for any of the trip/alarm conditions for which Output X: Enable is set, where X is one of the three relays A,B,C.

Multiple Alarm/Trip considerations

The MPS6 is designed to accept and store the first alarm it detects. If this alarm has not been reset and an additional alarm occurs, the MPS6 will not display the second alarm on the LCD nor assign it to the Fault Data page.
Example: If "Unbalance Alarm" occurs and then a "Thermal Pre-alarm" occurs, the MPS6 will continue displaying "Unbalance Alarm" message on both, LCD and Fault Data page. This is to assist the user in establishing the cause of the alarm.

In case a trip occurs after an alarm, the trip message will override the alarm message.

Tripping/Alarm Individual Settings

Maximum Start Time

Fault occurs when starting time is longer then "Maximum Start Time" setting. The MPS6 assumes end of starting process, when motor current decreases below 110% of the "Overload Pickup" value.
For a default value of 105%, end of starting process is detected at 115% of Motor Full Load Current (FLC).

Note: The following description presents the previous mentioned eight setting options (Trip, Alarm, Auto Reset, Panel Reset, PLC Reset, Output A, Output B, Output C) available for Max Start Time as well as for any of the other fault protections. In order to keep the text brief we avoided repeating this description for each of the remaining 31 protection functions.

Max. Start Time Trip: DISABLE	When Enabled, if starting time exceeds "Max Start Time" setting, the MPS6 trips. If Output A and Output B relays are configured as contactors A and/or B (common setting for MPS6-C), then internal relays A and B will open, opening motor contactors. If "Config. Output X" parameter is set to Trip, output X (A..F) relay energizes. If "Config. Output X" parameter is set to Trip - Fail Safe, output X relay de-energizes. Trip condition is latched. Range: DISABLE, ENABLE
Max. Start Time Alarm: ENABLE	When Enabled, and in case starting time exceeds Max Start Time setting, If Config. Output X parameter was set to Alarm Fail Safe, output X (A..F) relay de-energizes. If set to Alarm, output X relay energizes. Alarm condition is latched. Range: DISABLE, ENABLE
Max Start Time Auto RST: Dsabl.	When Enabled, Automatically resets Max Start Time fault after motor stops. Range: DISABLE, ENABLE.
Max. Start Time Panel Rst.:Enabl	When Enabled, allows Front panel resetting. If one input is set as Authorized Key and is connected, or if ***Param. Settings*** is set as Not Locked then panel reset is always active,

	ignoring Panel Rst setting. Range: DISABLE, ENABLE.
Max. Start Time Remot Reset:Enabl	When Enabled, allows Remote resetting through one of the six digital inputs if set as a remote reset. Range: DISABLE, ENABLE.
Max. Start Time Output A.:Disabl	When Enabled, causes output A relay to energize upon Max Start Time fault. Range: DISABLE, ENABLE.
Max. Start Time Output B: Disabl	When Enabled, causes output B relay to energize upon Max Start Time fault. Range: DISABLE, ENABLE.
Max. Start Time Output C: Disabl	When Enabled, causes output B relay to energize upon Max Start Time fault. Range: DISABLE, ENABLE.

Too Many Starts

Fault occurs when the number of starts exceeds the ***Number of Starts*** setting during ***Starts Period*** time.
Auto Reset, when Enabled, occurs after "Start Inhibit" time elapsed.
If one of the Discrete inputs A, B, C or D is configured as an ***Emergency Restart*** input and if this input (the Emergency Switch) is closed, then all starts performed are ignored. So, Too Many Starts fault is automatically disabled.
Note: Each output relays, can be configured as ***"# Strts Pre Alrm"*** (Number Of Starts Pre Alarm). In this mode the relay is energized if motor is stopped, as long as a new start would cause Too Many Starts fault. It can be used to prevent the next start as long as it is not allowed.

Under Current Level 1

For a running motor, fault occurs when current decreases below "***U/C Level 1***" setting, for a time longer than "***U/C Level 1 Delay***" setting.
Auto reset, when Enabled, occurs when current is above "U/C Level 1", or when motor stops or trips.

Under Current Level 2

For a running motor, fault occurs, when current decreases below **U/C Level 2** setting for a time longer than ***U/C Level 2 Delay*** setting.
Auto reset, when Enabled, occurs when the current increases above U/C level 2, or when the motor stops or trips.

Load Increased

Active only after start process ended (after current decreased to below 110% of Overload Pickup value). Fault occurs when motor average current is above "***Load Increase***" setting for more than 5 seconds. Auto reset, when Enabled, occurs when current decreases to below ***the Load Increase*** setting, or when motor stops or trips.

Over Current Level 1- Jam

This identifies a jam condition for a "running" motor. Fault occurs if after start process has ended, motor average current increases above ***O/C Level 1 - Jam*** setting value for more than ***O/C LEVEL 1 Delay***.
Auto reset, when Enabled, occurs when current decreases below ***O/C Level 1 - Jam***, or when motor stops or trips.

Over Current Level 2 - Short

This identifies short circuit condition. Fault occurs when any of the motor's line currents exceeds ***O/C LEVEL 2- Short*** value, for more than ***O/C LEVEL 2 Delay*** time.
Auto reset, when Enabled, occurs when current decreases to below the ***O/C Level 2- Short*** value, or when trips motor.
Notes:

1. True RMS line currents are measured, disregarding the average "DC" value. It is designed to prevent nuisance tripping at the very beginning of the starting process (during which DC decaying current is superimposed on the AC Current).
2. Minimum setting of "***O/C Level 2 Delay***" is 0. At 0 setting, the actual time delay is less than 70 ms.
3. O/C Level 2- Short is prevented when the highest of any of the line currents exceeds ***Current Inhibit*** setting. It is designed to prevent opening of motor contactor under high short circuit conditions to protect its contacts from being damaged. Fault display: "O/C Level 2- Short".
4. Thermal level 2 (Overload) overrides "Current Inhibit" setting.

Thermal Level 1 and 2

The MPS6 simulates the thermal condition of the motor and stores it in a thermal register. The content of the thermal register is called "Thermal Capacity". It simulates the motor temperature. Thermal capacity of 100% is equivalent to a motor running at the absolute maximum allowed temperature. At this point the motor must be tripped.
The following parameters are used to calculate the Thermal Capacity.

Curve Multiplier
This is a multiplier of the basic standard curve. It enables to shift the entire overload curve. For example, when ***Curve Multiplier*** is set to 1, time to trip of a cold motor at 2*In is 29.1 Sec. If Curve Multiplier is set to 10, time to trip of a cold motor at 2*In is 291 Sec.

Overload Pickup
Thermal Level 2 is not active for currents below the "***Overload Pickup***" value. For a standard motor, leave Overload Pickup at its default value of 105%. When current increases above this value a fault will occur after a given time. This time depends on the present value of the "Thermal Capacity", on the current level and on "***Curve Multiplier***" parameter.

Hot/Cold Ratio
This parameter, determines the ratio of the available "Thermal Capacity" for a Hot Motor and for a Cold Motor. The "Thermal Capacity" of a Hot motor, is (100 - Hot/Cold Ratio).

Cold Condition **-** When the motor is stopped for a long time, its "Thermal Capacity" is zero. Therefore, for a cold motor, all the 100% of "Thermal Capacity" are available for heating (before a trip occurs).

Hot Condition **-** When a motor is running, its temperature increases, and after it has been running for a long time at a current, slightly below the Overload Pickup value, a "Hot Condition" has been created. Now, less than 100% of the "Thermal Capacity" is available.
Example**:** If Hot/Cold Ratio is set to 60%, then for a "Hot" motor, 40% of the "Thermal Capacity" was used, leaving 60% for additional heating.
For a motor, running for a prolonged time, at lower than "Overload Pickup" current value, the "Thermal Capacity" is related to the value of the current.
For Example, if motor current is only ½ of the Overload Pickup level, then (K=(½)*40%=20%) only 20% of the "Thermal Capacity" has been used, leaving 80% for additional heating.

Run Cool T Const
This is the Cooling Time Constant for a running motor. When motor current is below the ***Overload Pickup*** value, Thermal Capacity is exponentially reduced, simulating motor cooling. Two different cooling time constants must be used. Cooling time constant is significantly larger for a stopped motor.

STP Cool T Const
This is the Cooling Time Constant for a stopped motor. When motor is stopped, Thermal Capacity is exponentially reduced, simulating motor cooling. Normally, ***STP Cool T Const*** is 3 – 6 times larger than the Cool Tow Run.

Unbalance K Factor (Unbalance Bias Factor)
Unbalanced currents cause additional motor (mainly Rotor) heating. Unbalanced currents cause negative rotating field, which generates rotor voltages and currents at twice the rated frequency. Further heating is caused as a result of the Skin Effect, which causes significant increase of rotor resistance. The Skin Effect is caused by the high frequency induced by the negative sequence field (compared to a frequency of approximately 1Hz, caused by the positive sequence field).
This additional heating is entered into the thermal model using the ***Unbalance K Fctr***. This factor changes the value of the motor equivalent current (I_{EQ}) used as the input current for the thermal model.
I_{EQ} is given by:

$$I_{EQ} = I\% * \sqrt{(1 + K * (I_N/I_P)^2)}$$

Where: I% - Motor RMS (average of the three phases) current
I_N - Negative sequence Current

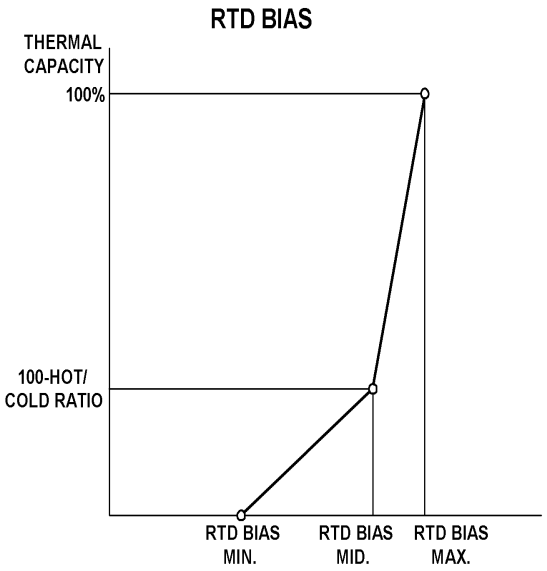
I_P - Positive Sequence current
K - The above Unbalance Bias Factor
I_{EQ} – Equivalent current, which takes into consideration the negative sequence extra heating.

RTD Bias

The Thermal model, as explained up to this point is based on current measurements only. It assumes normal ambient working temperature of approximately 40°C. If the ambient temperature is higher, or if forced and natural cooling of the motor is malfunctioning, the winding temperature can be significantly increased.
The RTD Bias is a possible way to take the actual winding temperature into consideration. The RTD are relatively slow elements, however they sense accurately the real temperature of the windings. Therefore, the RTD measurement can be used to correct the thermal model for slow motor heating, according to the actual winding temperature. The first parameter RTD Bias allows to disable RTD Bias, to use RTD1..3, for the temperature bias.
Note that when enabled, the RTD BIAS can only increase the Thermal Capacity value. It can never decrease it.
If ***Ch. 1 2 3 Sensor*** is not set to RTD then RTD Bias feature is not valid.

RTD Bias Minimum, RTD Bias Middle, RTD Bias Maximum

RTD Bias is entered to the thermal model by means of the three following parameters: ***RTD Bias Minimum***, **RTD Bias Middle**, ***RTD Bias Maximum***. The RTD Bias curve is created by two straight lines drawn between the following three points.
First point (RTD B.Min,0): RTD Min is the (horizontal) Minimum Bias temperature. Below this temperature the RTD Bias has no effect on the thermal model.
Second point (RTD B.Mid, 100-Hot_Cold_Ratio): RTD Mid is the normal expected working temperature with 100% load. At this point, the thermal capacity should be 100 – Hot/Cold ratio.
Third point (RTD B. Max,100): RTD Max is the maximum allowed working temperature. At this point, the thermal capacity should be 100%.
When the overload thermal capacity (including Unbalance Bias), is lower than the thermal capacity dictated by the RTD Bias, it will be automatically increased to the value of the RTD Bias curve value.
Note: If RTD temp is equal or above RTD Max the Thermal capacity will be increased to slightly below 100%. This is to prevent Overload Trip, if the value of the equivalent current is below Overload Pickup value. Normally, RTD trip should occur at or before this point.



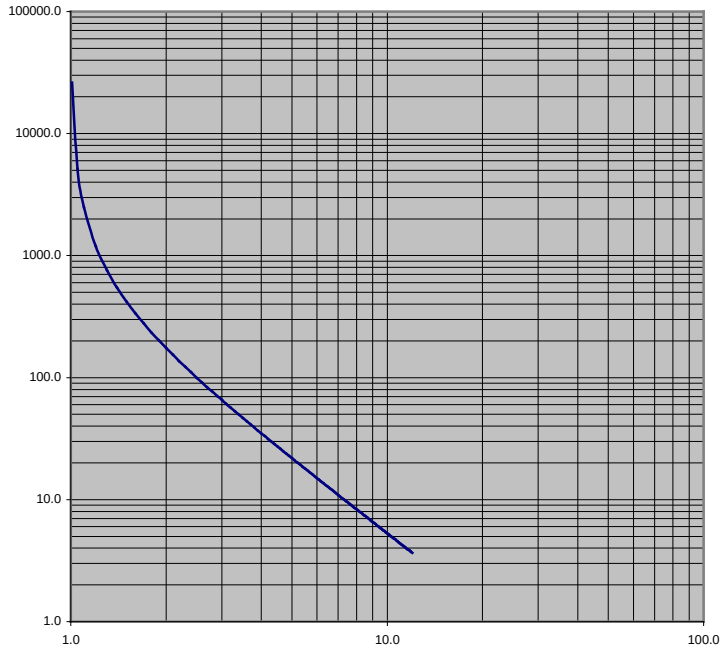
Thermal Level 1

This setting parameter is to be used for alarm only. When Thermal Capacity exceeds the set value, and if enabled, the MPS6 sets an alarm signal. A host computer can use this signal to read "Time to Trip" and determine the time left until the MPS6 will trip.

The last value of the Thermal Capacity is stored in the non Volatile memory during auxiliary supply failure or disconnection. On restoration of supply, the former value will be re-established.
Note: "Thermal Level 2" overrides "Current Inhibit" settings.

Next Figure and Table specify overload trip time delay for Curve Multiplier = 6..

CURVE MULTIPLIER = 6



Thermal Overload Table:

I / In	TIME	I / In	TIME	I / In	TIME	I / In	TIME	I / In	TIME
I / In									
1.01	26122								
1.05	5122								
1.10	2500	3.60	43.9	6.10	14.5	8.60	7.2	11.10	4.3
1.20	1193	3.70	41.3	6.20	14.0	8.70	7.0	11.20	4.2
1.30	760.8	3.80	39.0	6.30	13.6	8.80	6.9	11.30	4.1
1.40	546.8	3.90	36.9	6.40	13.1	8.90	6.7	11.40	4.1
1.50	419.9	4.00	35.0	6.50	12.7	9.00	6.6	11.50	4.0
1.60	336.5	4.10	33.2	6.60	12.3	9.10	6.4	11.60	3.9
1.70	277.7	4.20	31.5	6.70	12.0	9.20	6.3	11.70	3.9
1.80	234.3	4.30	30.0	6.80	11.6	9.30	6.1	11.80	3.8
1.90	201.1	4.40	28.6	6.90	11.3	9.40	6.0	11.90	3.7
2.00	174.9	4.50	27.3	7.00	10.9	9.50	5.9	12.00	3.7
2.10	153.9	4.60	26.0	7.10	10.6	9.60	5.8		
2.20	136.7	4.70	24.9	7.20	10.3	9.70	5.6		
2.30	122.3	4.80	23.8	7.30	10.0	9.80	5.5		
2.40	110.3	4.90	22.8	7.40	9.8	9.90	5.4		
2.50	100.0	5.00	21.9	7.50	9.5	10.00	5.3		
2.60	91.1	5.10	21.0	7.60	9.2	10.10	5.2		
2.70	83.4	5.20	20.1	7.70	9.0	10.20	5.1		
2.80	76.7	5.30	19.4	7.80	8.8	10.30	5.0		
2.90	70.8	5.40	18.6	7.90	8.5	10.40	4.9		
3.00	65.6	5.50	17.9	8.00	8.3	10.50	4.8		
3.10	60.9	5.60	17.3	8.10	8.1	10.60	4.7		
3.20	56.8	5.70	16.7	8.20	7.9	10.70	4.6		
3.30	53.1	5.80	16.1	8.30	7.7	10.80	4.5		
3.40	49.7	5.90	15.5	8.40	7.5	10.90	4.5		
3.50	46.6	6.00	15.0	8.50	7.4	11.00	4.4		

Table values are for Curve Multiplier = 6. For other value of Curve Multiplier divide table values by 6 and multiply by the required Curve Multiplier:

TIME = Time from table * Curve Multiplier / 6.

*Example 1: Find time to trip of a cold motor at 5In with **Curve Multiplier** = 8*
From the above table, time to trip at 5In, with ***Curve Multiplier*** = 6 is 21.9 Sec.
With ***Curve Multiplier*** = 8, time to trip is 8 / 6 * 21.9 = 29.2 Sec.

To find the time for a hot motor find first the time, as explained above, then multiply by the Hot/Cold ratio.

Example 2: *Find time to trip of a hot motor for the above example while **Hot/Cold ratio** is set to 60%.*
Solution:
Multiply the result of Example 1 by 0.6 (60%). 29.2 * 0.6 = 15.5 Sec.

Thermal Capacity Reset Method

It is not possible to reset (to empty) the thermal capacity.
Reset, of "Thermal Level 2", is prevented until "Thermal Capacity "cools down" bellow 50%. Therefore, even for a “Key Holder” reset of Thermal Level 2 trip is not possible for a cooling down period of time.

Emergency Restart

If one of the Discrete inputs is configured as an ***Emergency Restrt*** input and if this input (Emergency Restart Switch) is closed, then the Thermal Capacity automatically resets to 0 every time the motor is stopped. It is done to allow immediate restarting even if motor is hot. Closing the Emergency Restart switch while motor is already stopped causes also an immediate reset of the thermal capacity. As long as motor is running, the Emergency Restart switch has no effect. Therefore the MPS6 can still trip for Thermal Level 2 even if the Emergency Restart switch is closed.

Note: If an Emergency Restart input is used, RTD Bias should be set to OFF to ensure resetting of the Thermal capacity while motor is stopped.
Warning: Use only for emergency case. Open switch immediately after Emergency is ended.

Unbalance Level 1

Current unbalance is the Ratio between motor Negative Sequence current to its Positive Sequence current.

Unbalance = I_N / I_P (Limited to: Unbalance <= 100%)

If Motor average RMS current is less than the rated Motor FLC, then the Unbalance value is decreased by the factor Iavg / FLC, where Iavg is the RMS average of the three phase currents.

Unbalance = (I_N / I_P) * (Iavg / FLC)

This method prevents nuisance alarming at low currents. The MPS6 initiates an alarm, ***Unbalance Min T*** seconds after the actual unbalance value increases above 50% of Unbalance Level 2 setting.
Auto reset, when Enabled, occurs when the actual unbalance decreases to below 50% of "***Unbalance Lvl 2***" setting, or when motor stops or trips.

Unbalance Level 2 (*Unbalance Lvl 2)*

Unbalance Level 2 setting, determines the minimum value of actual unbalance for Unbalance level 2 fault.
If the actual unbalance exceeds ***Unbalance Lvl 2*** setting, a time delay is initiated. The time delay is related to ***U/B Lvl*** 2 Max T parameter, and to the inverse of the square of the actual unbalance (smaller delay for larger unbalance). Minimum value of the time delay is ***Unbalance Min T*** seconds.

Auto reset, when enabled, occurs when the actual unbalance decreases to below ***Unbalance Lvl 2*** setting, or when motor stops or trips. See next figure to select the required trip time for any unbalance value.

Note:
Mains phase sequence (positive or negative) as determined from the three motor currents is used while calculating positive and negative sequence currents.

Unbalance Protection

Notes: 1. Select the required trip/alarm time on the vertical axis (at 10% unbalance).
2. Draw an horizontal line at the selected point (for example, 5 Sec.).
3. Select an unbalance point (for example 40%).
4. Draw a vertical line at the selected point (the two lines intersect).
5. Draw a parallel line to the diagonal lines at the intersection point.
6. Insert the value of the time at the intersection point (from 5) into parameter U/B LEVEL 2 MAX T (for example 80 sec).

Undervoltage

Fault occurs when the voltage decreases below "U/V Level", for more than "U/V Delay" setting. ***UV Active At Stop*** determines if Undervoltage is active only after motor is started (Disable) or also at Stop (Enable).
Auto reset, when Enabled, occurs when average line voltage increases above the U/V Setting value, or when motor trips.

Over Voltage Level 1 (*O/V Level 1*)

This is active only after the start signal. Fault occurs when the average of three line to line voltages increases above "O/V Level 1" setting, for more than 1 second.
Auto reset, when Enabled, occurs when average line voltage decreases below "O/V Level 1" value, or when the motor trips.

Over Voltage Level 2 (*O/V Level 2*)

This is active only after the start signal. Fault occurs when the average line to line voltage increases above "Overvoltage Level 2" setting, for more than "O/V Level 2 Delay" setting.
Auto reset, when Enabled, occurs when average line voltage decreases to below O/V Level 2 value, or when the motor trips.

Phase Loss

The MPS6 calculates voltage unbalance according to the difference between maximum and minimum values of the line to line voltages, related to the "Line Volts" setting. Fault occurs when the unbalance level exceeds 20% for more than 2 seconds
Auto reset, when enabled, occurs when the actual Unbalance decreases below 20%.
Note: Set Trip and Alarm to DISABLE, if three phase voltage is not measured.

Phase Sequence

Active always. Fault occurs when the phase sequence is reversed.
Note: Phase sequence is calculated from the three motor currents only for a short while immediately after starting.
Auto reset (practical for alarm only, since trip will prevent next starting) , when Enabled, occurs when a correct phase sequence is detected at starting.

Ground Fault Level 1 (*GND Fault Lvl 1*)

Fault occurs when Ground current exceeds "***GND Fault Level 1***" setting for more than the "***G/F Level 1 Delay***" setting.
Auto reset, when Enabled, occurs when Ground current decreases below "***GND Fault Level 1***" setting. While starting, ***G/F During Start*** setting parameter overrides ***G/F Level 1***. Designed to eliminate nuisance alarming during start process (with high currents) when residual "C/T" connection is used.

Ground Fault Level 2 (*GND Fault Lvl 2*)

Fault occurs when Ground current exceeds "***GND Fault Lvl 2***" setting for more than "***G/F Level 2 Delay***" setting.
Minimum setting of "***G/F Level 2 Delay***" is 0. At 0 setting, the actual time delay is less than 70 ms.
Auto reset, when Enabled, occurs when Ground current decreases below "GND Fault Level 2" setting. While starting, G/F During Start setting parameter overrides ***G/F Level 2***. Designed to eliminate nuisance tripping during start process (with high currents) when residual "C/T" connection is used.

Note: GND Fault Level 2 fault is prevented when the highest of any of the line currents Exceeds "Current Inhibit" value. It is designed to prevent opening of motor contactor under high short circuit conditions, to protect its contacts from being damaged.

Communication Port Failed (*Comm. Port Failed*)

Fault occurs when the MPS6 detects three consecutive transmissions from the host computer, in which a parity bit, and/or the CRC word are wrong.
Auto reset, when Enabled, occurs when a transmission from the host computer is received properly.

Internal Failure

The MPS6 incorporates a Built In Test program. Operating the self test program is done from a special "Test/Maintenance Options" page. "Self Test Passed" message, after completion of the built in test, indicates that the MPS6 functions properly. "Self Test Failed", together with an error code (for factory use only) indicates a fault condition.
Auto reset, when Enabled, occurs when a successful test was performed and its result is "Self Test Passed" message.
Note: Most of the MPS6 self test programs are running continuously (much slower then the main program) in the "background".

Contactor Status(*Contactor Status*)

Contactor Status protection is active only if ***Protection Only*** is set to No.
Each one of the six digital inputs can be set as Contactor A N.O, Contactor A N.C, Contactor B N.O or Contactor B N.C. The MPS6-C determines if the motor contactors are open or closed by checking the position of their auxiliary contacts.
The MPS6 checks if contactor status is as it should be according to the actual status (motor stopped or at start/run).
Please note that the Contactor Status protection is operative only if at least one input is used to reflect contactor status.

Auto reset, when Enabled, occurs when motor contactors properly follow the MPS6-C commands.

Note: If motor contactors auxiliary contacts are not connected to the MPS6-C Inputs, both alarm and trip of "Contactor Status" faults must be disabled.

External Fault 1 / 2

External Fault 1or 2 occurs when the MPS6 detects closed contact in the digital inputs assigned as ***Ext Fault 1 N.O***, ***Ext Fault 1 N.C, Ext Fault 2 N.O*** or ***Ext Fault 2 N.C the***.
Auto reset of External Fault x, when Enabled, occurs when the "External Fault x" input circuit opens.

Temperature 1.. 3 Level 1.. 2 (*T1..T3 Level 1.. Level 2*)

High temperature condition is detected according to RTD measured resistance (RTD is a positive temperature coefficient device). For
Tx level 1 (2) fault condition is detected when the measured resistance of any channel x exceeds its Tx Level 1 (2) setting. Fault occurs after a fixed time delay of 2 seconds.

Auto reset, when Enabled, occurs when RTD resistance decreases below RTD x level 1 (2).

Notes:
1. A different model of MPS6 incorporates three Thermistor input circuits. When this type of unit is used, PTC (Positive Temperature Coefficient) or NTC (Negative Temperature Coefficient) types of thermistors can be selected. If PTC is selected, Fault occurs when resistance is above the set value. If NTC is selected, fault occurs when resistance is below the set value.
2. If the RTD connector is suddenly disconnected, the MPS6 reads????. If Level 1 is set as Alarm and Level 2 is set as Trip, the MPS6 will cause Alarm only and will not Trip.

The following table, shows the resistances of the PT100 RTD.

Resistance/Temperature Conversion Table

TEMP (°C)	Pt.100 Ohms (DIN 43760)
0	100.00
10	103.90
20	107.79
30	111.67
40	115.54
50	119.40
60	123.24
70	127.07
80	130.89
90	134.70
100	138.50
110	142.29
120	146.06
130	149.82
140	153.58
150	157.32
160	161.04
170	164.76
180	168.46
190	172.16
200	175.84

Under Power Level 1 (*Under Pwr Lvl 1*)

For a running motor, fault occurs when motor power decreases below "***Under Pwr Lvl 1***" setting for a period of time longer than "U/P Level 1 Delay" setting.
Auto reset, when Enabled, occurs when the power increases above "***Under Pwr Lvl 1***" level or when the motor trips.

Under Power Level 2 (*Under Pwr Lvl 2)*

For a running motor, fault occurs when motor power decreases below "***Under Pwr Level 2***" setting for a period of time longer than "U/P Level 2 Delay" setting.
Auto reset, when Enabled, occurs when the power increases above "***Under Pwr Level 2***" level or when the motor trips.

Low Power Factor

For a running motor, fault occurs when motor power factor decreases below "***Low Power Factor***" setting for a period of time longer than "***Low PF Delay***" setting.
Auto reset, when Enabled, occurs when the power factor increases above "***Low Power Factor***" level or when the motor trips.

The following table summarizes the eight factory default settings for each of the faults, and describes when is each fault active.

Notes: Prior to modifying this table, make a photocopy and do not mark on the original. Mark your settings in the empty space available for each value.

Tripping/Alarm Default Settings

In this table, (+) stands for "Enabled", (-) for "Disabled".

No. Fault	Trip	Alarm	Auto Reset	Panel Rst	PLC Reset	Output A	Output B	Active During	ANSI Code
1. Max Start Time	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Start	48
2. Too Many Starts	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Start	66
3. U/C Level 1	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	37
4. U/C Level 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	37
5. Load Increased	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	51L
6. O/C Level 1- Jam	(+) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	51R
7. O/C Level 2- Short	(+) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	50
8. Thermal Level 1	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49/51
9. Thermal Level 2	(+) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49/51
10. Unbalance Level 1	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	46
11. Unbalance Level 2	(+) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	46
12. Undervoltage	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run + Start	27
13. O/V Level 1	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run + Start	59
14. O/V Level 2	(+) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run + Start	59
15. Phase Sequence	(+) ( )	(+) ( )	(+) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	47
16. GND Fault Level 1	(-) ( )	(+) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	50G
17. GND Fault Level 2	(+) ( )	(+) ( )	(-) ( )	(-) ( )	(-) ( )	(-) ( )	(-) ( )	Always	50N
18. Comm. Port Failed	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	3
19. Internal Failure	(-) ( )	(+) ( )	(-) ( )	(-) ( )	(-) ( )	(-) ( )	(-) ( )	Always	3
20. Contactor Status	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Beginning of Start	74
21. External Fault 1	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	86 or 94
22. External Fault 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	86 or 94
23. T1 Level 1	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
24. T1 Level 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
25. T2 Level 1	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
26. T2 Level 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
27. T3 Level 1	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
28. T3 Level 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Always	49R
29. Under Pwr Level 1	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	32L
30. Under Pwr Level 2	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	32L
31. Low Power Factor	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	55
32. Unstable Current	(-) ( )	(-) ( )	(-) ( )	(+) ( )	(+) ( )	(-) ( )	(-) ( )	Run	??

Added options available in the MPS6 which correspond to ANSI codes

Lock-Out on thermal Trip	86
RTD Bias for Thermal Overload	??
Unbalance Bias for Thermal Overload	??
Low Speed switch of Two-Speed motor	??
Emergency switch effect on Thermal Overload (reset of thermal capacity when stopped)	??
Emergency switch effect on Too Many Starts (not recording starts while in emergency)	??
Fault Simulation (of Voltages, currents, temperature)	??

DATA PAGE - MENUS

These menus are accessed by pushing the Data Page button.

Measured Data

Measured
*** Data ***

Display	Description
Vp VL 230 400 V	Phase to Neutral voltages. Range: 100 V - 12.7 KV.
I1 I2 I3 137 138 139 A	Line (motor) currents. Range: 1 A - 24 KA.
Ground Current 0 Amp.	Ground current. 1 A - 2000A
Frequency 50.0 Hz	Mains frequency. 40Hz – 70Hz
Power 97.5 KW	Total motor power. Range: 0 - 30MW.
Reactive Power 60.5 KVAR	Total motor reactive power Range: 0 - 30 MVAR
Power Factor 0.89	Total (Average of three phases) motor power factor. Range : 0.0 - 1.00
T1 T2 T3 110 111 109 °C	RTDs or Thermistors 1 - 3 Temperature Range: 0°C - 200°C or 0 – 25.0K
In # 1 2 3 4 5 6 1 1 1 1 0 0	Status of each one of the six digital inputs Range: 0,1
Out # 1 2 3 4 5 6 1 0 1 1 0 0	Status of each one of the six digital inputs Range: 0,1

Calculated Data

Calculated
*** Data ***

Display	Description
Motor Load Curr. 90 % of FLC	Motor current as a percentage of Motor FLC. Range: 0 - 1200% of Motor FLC.
Equivalent Curr. 90 % of FLC	Equivalent Motor current (increased by unbalance according to Unbalance K Factor) as a percentage of Motor FLC. Range: 0 - 1200% of Motor FLC.

Unbalance Curr.
0%

Unbalance current. The ration between Positive Sequence current to Negative Sequence current. If Motor Load is less than 100% then the above ration is multiplied by the factor (Motor Load / 100) to prevent nuisance tripping

Thermal Capacity
30% of Capacity

Thermal Capacity used. Simulates motor's winding temperature according to the selected Thermal Overload Curve, to Unbalance Bias and to RTD Bias.

Trip Level = 100%

Time to Trip-O/L
No Trip Expected

Expected time to trip at the present current value which is above Overload Pickup.
Range: No Trip Expected - 18 Hours.

Time to Start
0 Sec.

Expected time to start, displayed in one of the following cases:

- After "Thermal Trip". This is the expected time of the Thermal Capacity to decay to 50% of the maximum "Thermal Capacity".
- After "Too Many Starts" Trip. In this case, maximum value of "Time to Start" equals "Start Inhibit" Time.

Range After "Thermal Trip": 0 - 166 minutes
After "Too Many Starts" : 1 - 60 minutes

"Time to Trip" The expected time until motor trips. (i.e. the time to reach 100% of Thermal Capacity if the present current value is maintained). This value is calculated and displayed on the LCD. The host computer may read this value through the serial link, and try to take some corrective actions.

"Time to Start" The expected time until it is possible to re-start after Thermal Trip (i.e. the time to reach 50% of Thermal Capacity) or after Too Many Starts. This value is calculated and displayed on the LCD.

Reset of the Thermal Capacity

If Emergency Restart switch is closed, then Thermal Capacity is automatically reset when motor is stopped, to allow immediate restart of a hot motor.

Statistical Data

Statistical Data
- **** -

Total Run Time
10137.5 hours
Total run time since commissioning.
Range: 0-30,000 hours.

Total # of Start
1017
Total number of starts since commissioning.
Range: 0-65535

Total # of Trips
12
Total number of trips since commissioning.
Range: 0-65535

Last Strt Period
5.2 Sec.
Last start time duration.
Range: 0-255 seconds.

Last Start Max I
350 amp.
Peak current (highest of three phases) during last start.
Range: 0-24000 amp.

Total Energy
457,235 KWH
Total (since last clearing of statistical data) accumulated motor active energy.
Range: 0-10,000,000 KWH.

Total React. En.
265,107 KVARH
Total (since last clearing of statistical data) accumulated motor reactive energy.
Range: 0-10,000,000 KVARH.

Minimum Voltage
395 volt
Latched (since last reset) minimum value of RMS Line voltage (average of three phase). Measured while motor is starting or running.
Reset is possible when message is displayed, by pressing Reset Key.

Maximum Voltage
395 volt
Latched (since last reset) maximum value of RMS Line voltage (average of three phases). Measured while motor is starting or running.
Reset is possible when message is displayed, by pressing Reset Key.

Minimum Current
73 Amp.
Latched (since last reset) minimum value of RMS Line Currents (average of three phases), Measure starts 20 seconds after motor is running.
Reset is possible when message is displayed, by pressing Reset Key.

Maximum Current
73 Amp.
Latched (since last reset) maximum value of RMS Line Currents (average of three phases), Measure starts 20 seconds after motor is running.
Reset is possible when message is displayed, by pressing Reset Key.

Min. Frequency
49.9 Hz
Latched (since last rest) minimum value of mains frequency.
Reset is possible when message is displayed, by pressing Reset Key.

Max. Frequency
49.9 Hz
Latched (since last rest) maximum value of mains frequency.
Reset is possible when message is displayed, by pressing Reset Key.

Fault Data

Fault Data
- ** -**

Last Trip RTD 3 Level 2	Last active fault that was Enabled as a Trip. Range: all 32 faults.
Last Alarm Load Increased	Last active fault that was Enabled as an Alarm. Range: all 32 faults.
Trip I1, I2, I3 129 132 130 A	Values of three line (motor) currents before last trip. Range: 0-24000 amp.
Trip GND Current 0 amp.	Values of Ground Fault current before last trip. Range: 0-24000 amp.
Trip Voltage 229 V	Values of phase to neutral voltages before last trip. Range: 0-25000 volt.
Last 10 Trips:	Header of next 10 screens showing the details of last 10 trips with time stamps.
External Fault 1 08:32 08/05/ 02	Last Trip with its time stamp.
RTD 1 LEVEL 2 13:33 06/13/02	Values of phase to neutral voltages before last trip. Range: 0-25000 volt.
O/C LEVEL 2 - Short 11:26 03/21/02	Values of phase to neutral voltages before last trip. Range: 0-25000 volt.

TEST / MAINTENANCE OPTIONS

Push Set Page & ▼simultaneously to enter the test & Test & Service page.

Test/Maintenance *** options ***

The test page is used for running the self-test, displaying program version, storing factory default parameters into the non volatile memory, resetting and storing statistical data, setting of Real Time Clock and for Simulation. “Unauthorized” personnel can only view the test screens.

Display	Description
Run Self Test ? Push "Value-up"	Press ▲ key to initiate the built in test procedure.
BTL-19/03/2006 MPS6-093092-Mb	Program version description.
Store Now ? Default Settings	Stores all factory default parameters in the non-volatile memory. Press **Store** and **Set Page** keys simultaneously, to store. "Data Saved Ok" message will be displayed for about two seconds.
Clear Now ? Statistical Data	Clears all statistical data. Press **Reset** and **Data Page** keys simultaneously, to reset and store zero values in the non-volatile memory. "Data Saved Ok" message will be displayed for about two seconds. The parameters are: • Total run time • Total # of starts • Total # of trips • Last start period • Last start max I • Thermal Capacity • Last Trip • Trip voltages and currents • Active Energy (KWH) • Reactive Energy (KVARH) • "Data Saved Ok" message will be displayed for about two seconds.
hh.mm mm.dd.yy 13:51 09/29/02	Real Time Clock date and time setting. Set and Store any of the five parameters (pointed by cursor) normally, as for any other setting parameter. Note that Store key forwards cursor to next parameter.

Warning

Default storing and resetting of statistical data should be done with care, since it is not possible to retrieve the previous "set page" parameters or statistical data.
Setting Default parameters, delete all previous stored settings. !
Clearing Statistical Data resets all previous statistical data values. !

Note: For longer life, the Real Time Clock uses a backup capacitor and not a backup battery. The Backup capacitor retains data and keeps clock running for a few days. If the MPS6 is not powered for longer period, the clock has to be initialized. Initialization can be done manually as described above or through serial link.

Simul. Voltage =
400 VOLT

For Simulation. Set here the required Line to Line voltage. No need to press the Store key. Can be changed before or while simulation is "running". Default value is automatically set to ***Line Volts (Vn)*** setting at system parameter setting page.

Simul. I1, 2, 3
120 AMP

For Simulation. Set here the required Currents. It sets the three currents I1, I2, I3 to same value. Next two parameters allow changing of I2 and I3 simulation settings. Can be changed before or while simulation is "running".

Default value is automatically set to 1.2 times ***Motor FLC*** setting at system page.

Simulation I2
120 AMP

For Simulation. Use to change value of Simulation I2 Current (so, it will be different from Simulation I1). Useful for testing of Unbalance and of Unbalance Bias of Thermal model. Can be changed before or while simulation is "running".

Default value is automatically set to 1.2 times MOTOR FLC setting at system page.

Simulation I3
120 AMP

For Simulation. Use to change value of Simulation I2 Current (so, it will be different from Simulation I1). Useful for testing of Unbalance and of Unbalance Bias of Thermal overload model. Can be changed before or while simulation is "running".

Default value is automatically set to 1.2 times MOTOR FLC setting at system page.

Simulation I0
0 AMP

For Ground Fault Simulation. Use to change value of Simulation I0 Current. Can be changed before or while simulation is "running". Useful for testing ground fault protection. Default value is automatically set 0.

Simul. T1, 2, 3
40 °C

For RTD High Temperature Fault Simulation. Set here the required Simulation Motor Windings Temperature. Useful for testing RTD alarms and Trips as well as RTD Bias for Thermal Overload model. Can be changed before or while simulation is "running".

Default value is automatically set 40 °C.

Run Simulation ?
OFF

By setting to Start / Run, the previous voltages, currents and Temperature values are used by the relay as if they were real actual values. Values may be changed before or during "run time". Useful for Testing the MPS6 as well as getting familiar with the relay features and operation, "on the Engineer Table".
Operative only during first ten hours since the MPS6 is powered. After that time "NOT POSSIBLE NOW" message is displayed.
<u>To Simulate after more than ten hours, turn OFF the Auxiliary power supply, the turn ON again.</u>

Test Example:

When Protection Only setting at system page is set to Yes.

Setting Run Simulation to Start / Run with the default values, causes the currents to equal 120% of rated motor current. Therefore the Start LED is turned ON. If value of current is not changed MAX START TIME may occur after the setting delay. If current is reduced, Run LED is turned ON and the MPS6 enters to running status.

View the Measured data and the Calculated data. Change Simulation I2 or I3 to cause Unbalance. Change Simulation I0 to check Ground Fault protection. Change Simulation T1,2,3 to check RTD faults protection. Check Thermal Capacity value and influence of RTD and Unbalance Bias.

COMMUNICATIONS – SERIAL LINK

The MPS6 is equipped with a powerful data communication system, operating beyond a motor protection controller into the realm of a complete motor management system.

This communication system is unmatched in its reliability, flexibility and ease of use providing the ideal basis for the design of a modern motor management system.

The MPS6 incorporates two serial link channels:

1. Rear RS485 serial link that uses a MODBUS RTU protocol (The protocol is not included in this document) to provides high speed data acquisition to supervisory computers.
2. Front ES232 MODBUS RTU protocol.

Data formats have been carefully structured to provide fast notification of alarms and continuous updates of performance parameters. Load control can be performed from host computers or by PLCs.

The following information and control can be accessed through the communication.

- All Actual data values
- All MPS6 Parameter Settings (Read & Write)
- All the control commands for the MPS6-C (such as Start A, Start B, Stop)
- Reset

See MPS6 Communication instruction manual.

The MPS6 system is user expandable. No special engineering skills or tools are required.
For small systems, the Host computer can communicate directly with the MPS6 via a twisted shielded pair.

For larger systems a Data Highway enables multiple MPS6 connection. Up to 32 MPS6s can be added on each twisted pair of the Host serial link with full access to all MPS6's.

The system also performs high speed data acquisition Users therefore have a simple and friendly means of building a fully integrated monitoring and control systems.

System reliability is exceptionally high, meeting the highest standards of reliable communication in the industry. Included in each message is a 16 bit CRC.

Note: Protocols other than MODBUS RTU available upon consultation.
Note: Terminate serial link cable with 120 Ohm resistors at both ends.

TECHNICAL SPECIFICATIONS

Auxiliary Power Supply

AC/DC Power Supply:

Standard voltage version: 85 - 250 V (for 110V or 220V AC or DC)
Low voltage version: 19 - 60 V (for 24V or 48V AC or DC)
Frequency: DC, 45 to 65 Hz.
Power consumption: Less than 20 VA

Phase Current Inputs (three current)

Method : True RMS, sample time 0.5 ms.
Range: 0.05 to 12 * phase "C/T" Primary amps setting.
Full scale: 12 * phase "C/T" Primary amps setting.
Accuracy: ± 1.5% , for 0.9 to 1.5 * "C/T" Primary amps setting.
± 5% above 1.5 * "C/T" Primary
± (3% + 0.02 * "C/T" Primary) below 0.9 * "C/T" Primary
Power consumption: ≤ 0.1 VA per 1 A at 1 A. input, (Input impedance ≤ 100 mΩ)
≤ 1.0 VA per 5 A at 5 A. input, (Input impedance ≤ 20 mΩ)

Ground Fault Current Inputs (one current)

Method : True RMS, sample time 0.5 ms.
Range: 0.05 to 1.0 * G/F "C/T" Primary amps setting.
Full scale: 1.0 * G/F "C/T" Primary amps setting.
Accuracy: ± 3% of full scale.
Power consumption: ≤ 0.1 VA per 1 A at 1 A. input, (Input impedance ≤ 100 mΩ)
≤ 0.5 VA per 5 A at 5 A. input, (Input impedance ≤ 20 mΩ)

Voltage Inputs (One voltages)

Method : True RMS, sample 0.5 ms.
Power consumption: ≤ 0.2 VA
Range: 50 - 400 volts.
Full scale: 400 volts.
Accuracy: ± 1.0% of full scale.

Temperature Inputs (Three RTD / Thermistors)

Time delay: 2 Sec.
Range: PT100, Ni120: 0°C - 200°C
PTC or NTC thermistor Model: 0 – 25.0 KΩ
Accuracy: ± 3% of resistance.
Max wire resistance: 25% of Sensor resistance at 10°C

Analog Output:

Range: 0-20mA or 4-20mA.
Accuracy: 2% of Full Scale + 3% of input.

Overload Alarm and Trip Curves (both heating and cooling)

Fault time accuracy: ± 1 second up to 10 seconds.
± 1 second +/- 2% above 10 seconds.

Threshold current level: Overload Pickup ± 1.5%.
RTD Bias (only with RTDs, not valid with Thermistors), Unbalance Bias.

Total Run Time

Accuracy: ±2%.

Current Unbalance Alarm and Trip

Method: Unbalance = 100 * (Negative Sequence Current / Positive Sequence Current) [%]
If Motor Load < 100% then multiply by * (Motor Load / 100)
This is to prevent nuisance tripping at low current levels.

Level 1

Threshold Unbalance Level 1: 50% of Unbal Current setting ± 2%.
Alarm (fixed) time delay: 1.0 ± 0.5 Sec.

Level 2 Curves

Threshold Unbalance Level 2: Unbal Current setting ± 2%.
Trip time accuracy: ± 1 second up to 10 seconds.
± 1 second +/- 2% above 10 seconds.

Fault Time Delays

Accuracy: ±0.5 Sec. or ±2% of time, which ever is greater, for all but the above mentioned faults and the following exceptions:
* Overcurrent Level 2: When adjusted to 0 >>> 60 ms +/- 20 ms. -0.1/+0.2 Sec. up to 1 Sec.
* Ground fault trip: -0.1/+0.2 Sec. for less than 1 Sec. delay.

Relays Contacts

Maximum voltage: 250VAC.
Relays A,B,C,D: N.O. type, 5A / 250 VAC resistive, 750VA. The relays share one common terminal.
Relays E and F: Change Over (form C) type, 8 A / 250 VAC resistive, 1800 VA.

Dielectric Strength

1500 VAC, for 1 minute, Between Ground (terminal 1) and:

- ***** Current inputs.
- ***** Voltage input.
- ***** Auxiliary power supply inputs
- ***** Discrete Input terminals

Power and Reactive Power Measurements

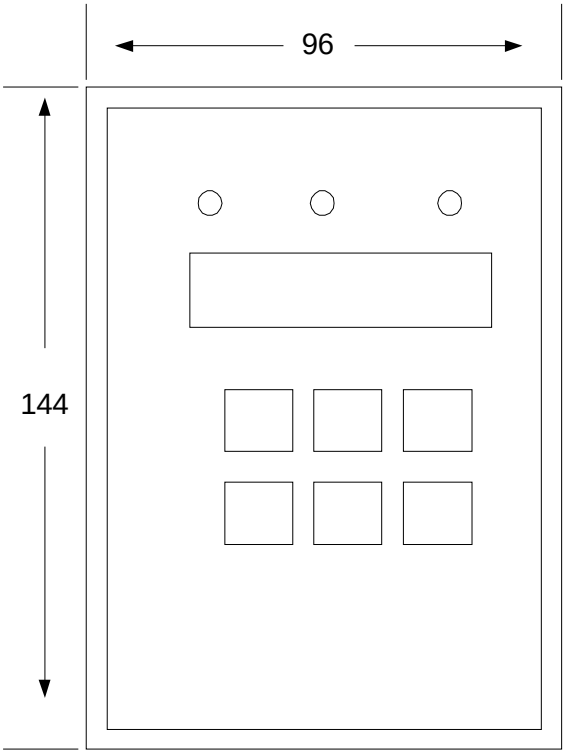
Method: True RMS over three phase voltages and currents.
Range : 0.1 KW - 5MW (0.1 KVAR - 5 MVAR)
Full Scale : 5MW (5 MVAR)
Resolution : 0.1 KW below 1 MW, 0.01 MW above 1 MW.
Accuracy : For V ≥ 90% of rated voltage & Power factor ≥ 0.5.
Two Ranges : 1. For (10% < I ≤ 150%) of "C/T" primary, accuracy is :
± (2% + 0.01 * "C/T" Primary/ Motor FLC.) of motor rated Power
2. For (I ≥ 150%) of "C/T" primary, accuracy is :
± 7% of the display reading

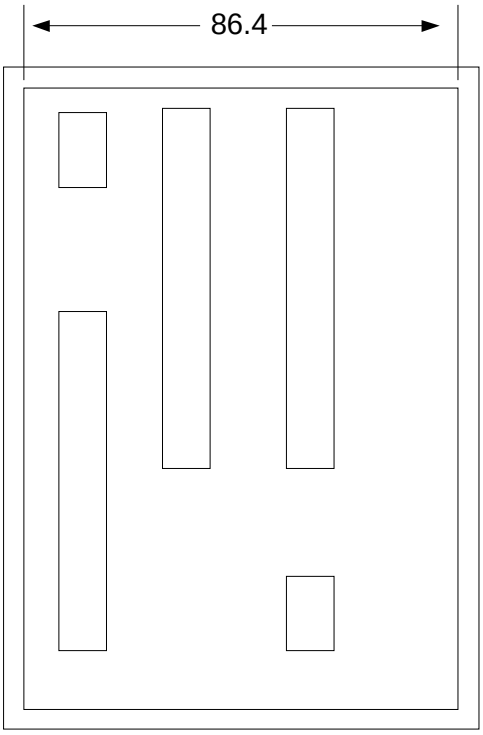
Power Factor

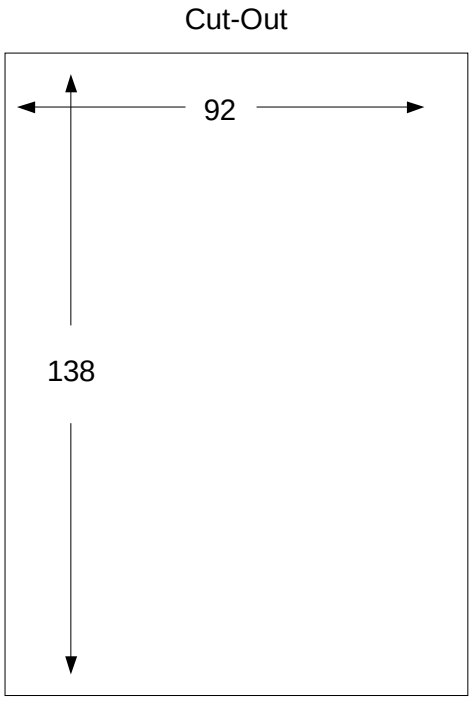
Method: Ratio between total power (P) to total apparent power (VA).
Range : 0.0 - 1.0 leading / lagging.
Resolution : 0.001
Accuracy : For V ≥ 90% of rated voltage & I ≥ 50% of "C/T" Primary & Power factor ≥ 0.7 it is ± 0.03

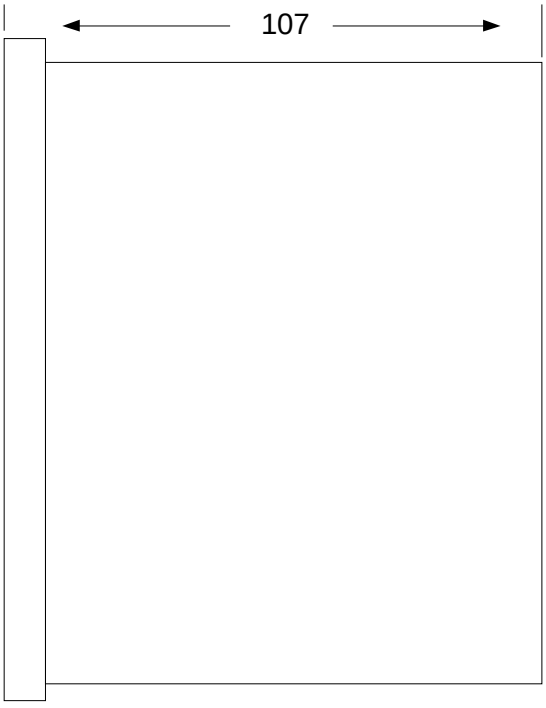
Ambient Temperature 0°C to +50°C

CASE AND CUTOUT DETAILS









NOTES

NOTES

NOTES

Solcon Industries Ltd.
TEL:972 4 9890311 FAX:972 4 9890233 POB 635 YOQNEAM ILLIT . 20692 ISRAEL.
www.solcon.com Technical support: office@solcon.com