



Tornado F-1

Motor Controller

Operator Manual





Global Production Solutions

Tornado F-1 Motor Controller OPERATOR MANUAL

Revision 2.0

Change Log

Rev	Date	By	Description
			1.6:1.5_4.2012
2.0	04/28/2012	GPS	GPS and formatting improvements from F5 manual



Table of Contents

CHAPTER 1 Specifications	1
CHAPTER 2 Overview	2
CHAPTER 3 Installation	6
CHAPTER 4 Digital Input (DI)	7
CHAPTER 5 Panel Light Indication	9
CHAPTER 6 Shutdown and fault Handling	10
CHAPTER 7 Parameter List	11
CHAPTER 8 Parameter Definitions	12
APPENDIX A Product Warranty	14





Chapter

1 Specifications

Display/Motor Control Unit

- Size (w x l x h): 4.75" x 6.00" x 2.50" (base plate dimensions)
- Weight: 3.0 pounds
- NEMA rating: NEMA 1
- Power: 110V AC (+/- 10%), 0.25A load
- Digital Inputs: one: 120 Volts AC Input
- CT Inputs: three: one for each phase. CT range is 0-5 amps and should be set according to the tap point during installation to obtain correct operation.
- PT Input: one: PT input is to Pins 1 and 2 on the Control Unit, and monitors the voltage between Phase A and Phase C.
- Outputs: Three, Contactor, Amber indicator, and Red indicator closure for front panel indicators. Output may be 110VAC or Ground, depending on relay common configuration.



Chapter

2 Overview

Safety Warnings

Read and follow all Warnings, Precautions, Notes, and Instructions included in this document.

- A Warning identifies an immediate hazard that exists that poses some probability of causing death or serious injury.
- A Caution identifies potential conditions and actions that have the possibility of death or severe injury.
- A Note identifies the need for general safety practices which, if violated, could cause injury to personnel or damage to equipment.



Warning

High voltages are exposed during operation. Do not touch exposed surfaces during test.

Caution

Verify wiring connections prior to applying power to the system. Damage to the equipment could result from incorrect connections.

Note

Inspect system ground and bonds prior to power application. Shock hazard could exist if proper ground is not maintained.



Display / Motor Control Unit



Warning

The Display/Motor Control unit derives its power from the Power Transformer (PT), which is connected to the high voltage lines into the switchboard. High voltages are present during operation and set-up, and should be considered hazardous.

Specific connections for the Display and Motor Control unit as well as parameter definition and values are given in other sections within this manual. In this section, an overview will be provided as an introduction to the operation of the Display and Motor Control unit. Reference Figure 1 in the following descriptions.

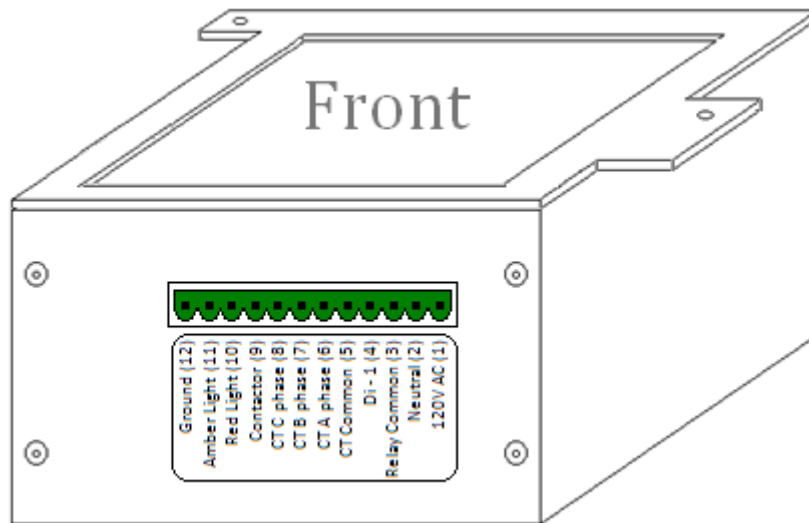


Figure 1- Typical Wiring Connection



PINS 1 & 2	These two pins are connected to the Power Transformer (PT), and provide the voltage base between Phase A and Phase C of the motor input power. The voltage is expected to be 110 VAC, and achieves this value through tap settings on the PT. Care must be taken to ensure the correct PT tap is set to prevent possible damage to the Display/Motor Control Unit.
PINS 3, 9, 10 & 11	These pins provide AC power and or Common for use with indicators, relays, or other devices requiring AC power for operation.
PIN 4	This is the DI #1 Input and can be used with dry type contacts. It can be used as normally open (NO) or normally closed (NC) configured sensors, as determined by the parameter setting. Its use is installation requirement driven.
PINS 5, 6, 7 & 8	<p>These pins are associated with the Current Transformers (CT). Pins 6, 7, and 8 are the inputs from the CT's associated with the three phases of current flowing to the motor. Pin 5 is the common for the three taps. The CT's are all 0-5 amp range, and must have the proper tap setting to provide the correct sensing and check values during system operation. The tap setting should be the lowest that will permit the CT to maximize the amps/amp range of the input, with some allowance for over current occurrences.</p> <p>In conjunction with the CT inputs, the Motor Controller has parameter set points for over and under current sensing conditions. These provide motor shutdown signals as required for motor safe operation. There is also a start-up time delay that allows the motor to come to normal operation before the over/under sensing begins.</p>
PIN 9 (Contactor/ Green Indicator)	Enables motor contactor to energize, turning on motor. A green indicator may be tied to this line for motor running indication.
PIN 10 (Red Indicator)	Will normally be on for any of the following conditions: <ul style="list-style-type: none"> • an alarm is active • last shutdown caused by alarm configured as Lockout • Hand/Off/Auto switch is in OFF or HAND position
PIN 11 (Amber Indicator)	Will normally be on for any of the following conditions: <ul style="list-style-type: none"> • all alarms are clear • automatic restart will occur on delay timeout
Start	Start button is on the front of the controller. This causes the motor to start given all conditions are correct.
Hand	Hand Input on front of controller selected when no automatic restart wanted.
Off	OFF Input on front of controller selected when shutdown is required and no automatic restart is wanted.
Auto	AUTO Input on front of controller selected when operator requires automatic restart of unit upon fault shutdown when setpoints are correct.



Display / Motor Control Unit

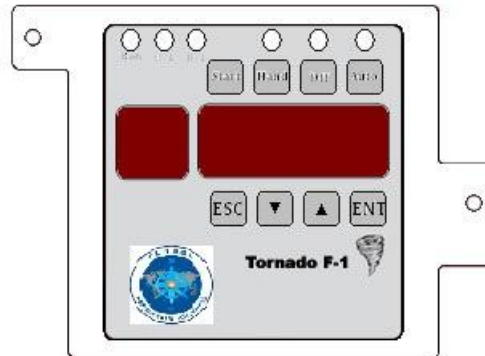


Figure 2 – Display / Motor Controller Unit

The Display/Motor Controller Unit is a permanently installed piece of equipment. The ESC key permits the operator to switch back to the last menu. Once the selection is made via the ENT (Enter) key, the UP and DOWN arrow keys permit the operator to increase the flashing displayed value (UP) or decrease the value (DOWN) to arrive at the desired parameter or setpoint. Once the desired point is reached, the ENT (Enter) key can be pressed to enter the data into the motor controller memory. The HOA switch is broken out into three buttons. HAND is a manual start of the motor and does not allow auto restart. OFF is to terminate the running of the motor. AUTO allows the unit to restart automatically if setup perimeters are met.

Front panel display indicators aluminates upon selection or activation.

The small red window displays two alphanumeric characters representing parameter number.

The large red window displays four alphanumeric characters representing parameter setpoint. (Changeable while flashing)



Chapter

3 Installation



Warning

The Motor Control unit derives its power from the Power Transformer (PT), which is connected to the high voltage lines into the switchboard. High voltages are present during operation and set-up, and should be considered hazardous.

Display/Motor Control Unit

The Display/Motor Control Unit can be mounted inside the ammeter enclosure using the existing hardware. A typical installation is shown in Figure 3, with an industry standard Phoenix 12 pin connector (supplied).

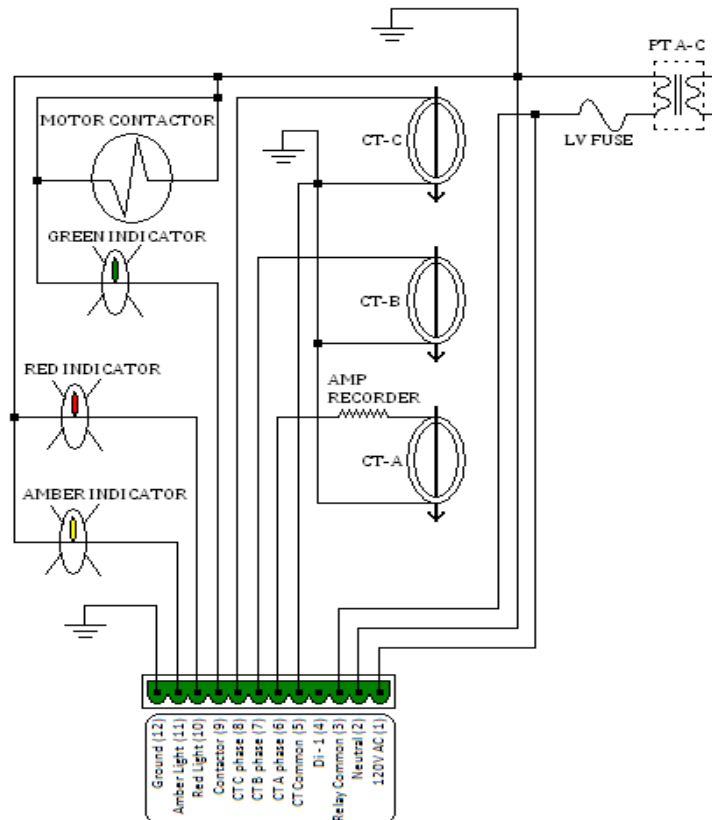


Figure 3 - Typical Switch Board Connection



Chapter

4 Digital Input (DI)

The Display/Motor Control Unit has one digital input. This can be utilized for dry contact remote shutdowns. The digital input can be configured for either N/O or N/C operations via software parameter list. Input of 120VAC constitutes a closure.

The Display/Motor Control Unit parameter list default setting is N/O. An example of setup is illustrated in Figure 4 below:

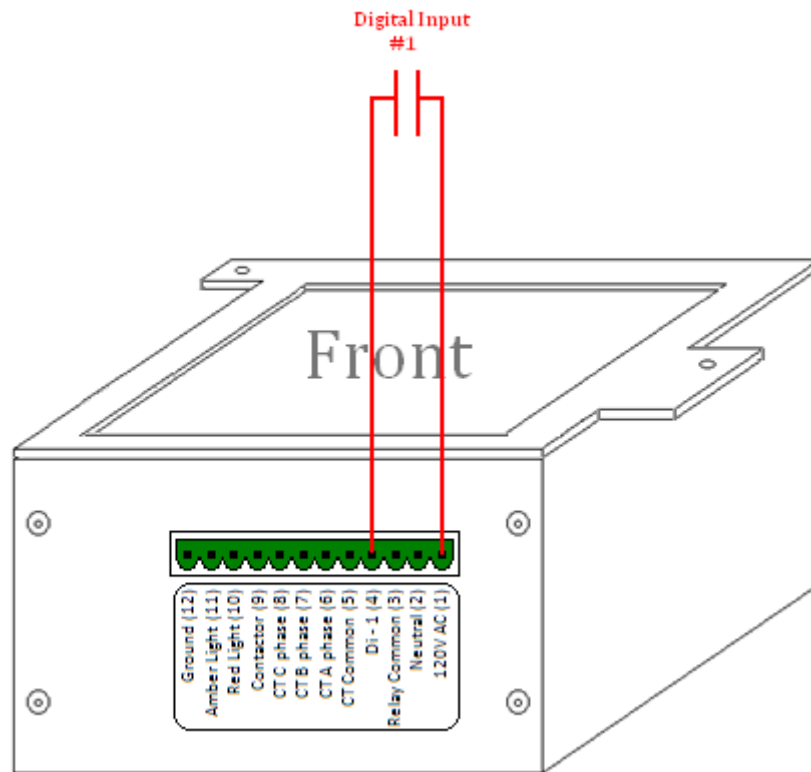


Figure 4 - Typical Digital Input



In the example, DI #1 is set to N/O. If the input to DI #1 is 120VAC, the motor controller will time out and shutdown. This is an example of N/O versus N/C configuration.

As mentioned above, there is a 'shutdown' timer for the DI #1 input. This is the determining factor of how long the motor controller will allow the equipment to continue to run in alarm status. Additionally, there is another timer for DI #1 Start With Active Alarm. The purpose of this timer is to allow the equipment to reach normal operating status after start-up. It must be noted on startup that these timers are cumulative. The 'shutdown' timer will not initiate its timing function until the 'delay on start timer' has reached its setpoint value.

Example #1:

Allow Start With Active Alarm on DI #1 set to 'NO'. The Motor Controller receives a fault on DI #1 the contactor is opened after the DI #1 Shutdown Delay timer has reached its setpoint. The Restart Timer will count down to its setpoint time and cease timing. It will stay in this dormant state until the alarm is cleared on DI #1.

If Allow Start With Active Alarm on DI #1 had been set to "YES" in this instance, the unit would have restarted automatically after the Restart Timer timed out regardless of the active alarm state and when DI #1 Shutdown Delay Timer has reached its setpoint it would again open the contactor and start the Restart Timer again if Active Alarm is still present.



Chapter

5 Panel Light Indication and Auto Restarts

The indicators in a normal application will consist of a Red, Amber, and Green indicators.

The green indicator is normally wired in parallel with the motor contactor off terminal 9 of the Motor Controller and is an indication of the unit operating.

The Amber indicator is connected to terminal 11 of the Motor Controller. The Amber indicator is no longer used in the Kratos functionality mode where it was used to indicate an Underload condition. An Amber indication illuminated serves to display to the user there are no active alarms and the Motor Controller is timing out and WILL allow an automatic restart when the restart timer has reached zero.

The Red indicator is connected to terminal 10 of the Motor Controller. The Red indicator is no longer used in Kratos functionality mode where it was used to indicate an overload condition. A Red indication illuminated serves to indicate to the user that an active alarm is present and an automatic restart WILL NOT be allowed.

Automatic restarts are allowed only if no active alarms are present OR an active alarm has been approved in the Parameter list to allow a restart. An example of this would be Start with Active Alarm discussed above.



Chapter

6 Shutdowns and Fault Handling

Each fault has its own specific set of allowable restart counters in the Menu list. UL is used strictly to control the maximum allowed Underload restarts.

The Reset Time functions as an internal counter reset to clear all categories of start counters. It is a time based value. Simply stated, if the unit operates the motor for a time exceeding the value in the reset time all internal shutdown counters are reset.



Chapter

7 Parameter List

ID	Parameter Name	Maximum	Minimum	Units	Field Adjustable	Default
1	A Phase Current	999.9	0	Amps	X	N/A
2	B Phase Current	999.9	0	Amps	X	N/A
3	C Phase Current	999.9	0	Amps	X	N/A
4	Time Until Auto Restart	999	0	Minutes		
5	Reason No Restart					
6	Underload Setpoint	999.9	0	Amps	X	20
7	Overload i2t Factor	127	0	N/A	X	64
8	Overload Setpoint	999.9	0	Amps	X	80
9	Current XFMR Ratio (X:5)	5-1250	0	Amps	X	100
10	Number of Allowed Underload Restarts	0-100	0	N/A	X	3
11	Number of Allowed Overload Restarts	1-100	0	N/A	X	0
12	Digital Input #1 N/O or N/C	N/O	N/C	N/A	X	N/O
13	Allow Start with Active Alarm on Di-1	YES	NO	N/A	X	N/O
14	Restart Time	1-999	0	Minutes	X	30
15	Reset Time	1-999	0	Minutes	X	30
16	Underload Delay on Start	1-999	0	Seconds	X	10
17	Underload Shutdown Delay	1-999	0	Seconds	X	30
18	Digital #1 Delay on Start	1-999	0	Seconds	X	5
19	Digital #1 Shutdown Delay	999	0	Seconds	X	5
20	PUV	History Event				
21	PUV	History Event				
22	PUV	History Event				



Chapter

8 Parameter Definitions

Parameter #1 A Phase Current	This is a real time value of the actual current passing through the A Phase current transformer. This parameter is adjustable for fine tuning purposes.						
Parameter #2 B Phase Current	This is a real time value of the actual current passing through the B Phase current transformer. This parameter is adjustable for fine tuning purposes.						
Parameter #3 C Phase Current	This is a real time value of the actual current passing through the C Phase current transformer. This parameter is adjustable for fine tuning purposes.						
Parameter #4 Time Until Auto Restart	This is a real time value representing the time until the MOTOR CONTROLLER will attempt to automatically restart the equipment						
Parameter #5 Reason For No-Restart	<p>This gives the user indications of what active alarms are present prohibiting the MOTOR CONTROLLER from starting the equipment. Below is a list of possible display and corresponding meanings.</p> <table border="1"> <tr> <td>OLRS</td> <td>Exceeded Number of Allowed Overload Restarts</td> </tr> <tr> <td>ULRS</td> <td>Exceeded Number of Allowed Underload Restarts</td> </tr> <tr> <td>DIG1</td> <td>DI1 Digital Input 1 Active</td> </tr> </table> <p style="text-align: center;"><i>Table 1 - Alarm Indications</i></p>	OLRS	Exceeded Number of Allowed Overload Restarts	ULRS	Exceeded Number of Allowed Underload Restarts	DIG1	DI1 Digital Input 1 Active
OLRS	Exceeded Number of Allowed Overload Restarts						
ULRS	Exceeded Number of Allowed Underload Restarts						
DIG1	DI1 Digital Input 1 Active						
Parameter #6 Underload Setpoint	This is a user defined value. If the AVERAGE of the three currents (parameter #4) falls below this setpoint for a duration that exceeds the Underload delay timer, the MOTOR CONTROLLER will stop the operation of the equipment.						
Parameter #7 Overload i(2)T Factor	This is a user defined parameter. This is the reaction factor for initiating an Overload trip. Default setting is 64 but can increase up to 127 if the motor is hard starting this will need to be increased to allow the motor to start without overloading and doing so will not considerably change the overload shutdown delay time.						
Parameter #8 Overload Setpoint	<p>This is a user defined parameter. If the average current exceeds this setpoint the MOTOR CONTROLLER will stop the operation of the equipment.</p> <p>The time it take to initiate an overload trip depends on the amount the average current exceeds the overload setpoint and the i2t factor in parameter #7.</p>						
Parameter #9 Current Transformer Ratio (X:5)	This is a user defined parameter. The actual current transformer value is entered in this parameter. It is based on X: 5. if you are using 75:5 CT's, then the value of 75 will be entered.						
Parameter #10	This is a user defined parameter. The maximum number of allowed						



Number Of Allowed Underload Restarts	Underload restarts before the MOTOR CONTROLLER will perform a lockout condition.											
Parameter #11 Number Of Allowed Overload Restarts	This is a user defined parameter. The maximum number of allowed overload restarts before the MOTOR CONTROLLER will perform a lockout condition.											
Parameter #12 Digital Input #1 N/O or N/C	This is a user defined parameter. If "N/C" is entered into this parameter the MOTOR CONTROLLER will stop operation of the equipment if 120VAC IS NOT present on terminal #4. If "N/O" is entered into this parameter the MOTOR CONTROLLER will stop operation of the equipment if 120VAC IS present on terminal #4											
Parameter #13 Allow Start with Active Alarm on Digital Input #1	This is a user defined parameter. If this parameter is set to "NO" the MOTOR CONTROLLER will not allow an automatic restart or a manual start with Di-1 alarm active.											
Parameter #14 Restart Time	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER must wait before it attempts an automatic restart.											
Parameter #15 Reset Time	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER must be operating the equipment (RUN) before the Underload, Overload, and Fault counters are reset											
Parameter #16 Underload Delay on Start Timer	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER will ignore an active Underload on startup before it initiates a stop command.											
Parameter #17 Underload Shutdown Delay Timer	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER will ignore an active Underload while running before it will initiate a stop command.											
Parameter #18 Digital Input #1 Delay On Start Timer	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER will ignore an active Digital Input #1 alarm on startup before it initiates a stop command.											
Parameter #19 Digital Input #1 Shutdown Delay Timer	This is a user defined parameter. The value entered in this parameter is the time the MOTOR CONTROLLER will ignore an active Digital Input #1 alarm while running before it will initiate a stop command.											
Parameter #20 Alarm @ Last Shutdown	This parameter displays the last shutdown alarm that occurred.	<table border="1"> <tr> <td>OLD</td> <td>Current overload</td> </tr> <tr> <td>ULD</td> <td>Current Underload</td> </tr> <tr> <td>DI1</td> <td>Digital Input 1 Active</td> </tr> <tr> <td>MAN</td> <td>Manual stop</td> </tr> <tr> <td>PUV</td> <td>Power failed</td> </tr> </table> <p><i>Table 2 – Legend for Parameters #20 - #22</i></p>	OLD	Current overload	ULD	Current Underload	DI1	Digital Input 1 Active	MAN	Manual stop	PUV	Power failed
OLD	Current overload											
ULD	Current Underload											
DI1	Digital Input 1 Active											
MAN	Manual stop											
PUV	Power failed											
Parameter #21 Alarm @ 2nd Last Shutdown	This parameter displays the 2nd last shutdown alarm that occurred.											
Parameter #22 Alarm @ 3rd Last Shutdown	This parameter displays the 3rd last shutdown alarm that occurred.											



Appendix

A Product Warranty

WARRANTY COVERAGE:

Global Production Solutions (“GPS”) warrants GPS manufactured products (“Product”) to be free of workmanship and material defects for a period of eighteen (18) months from the date of shipment to Buyer or twelve (12) months from the date of installation.

GPS, at its option, will at no charge either repair, replace, or refund the purchase price of the Product during the warranty period, provided it is returned in accordance with the terms of this warranty to 35431 Hardesty Road, Shawnee, Oklahoma USA 74801, at GPS option, may include the replacement of parts or boards with functionally equivalent reconditioned or new parts or boards. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts, boards or Product shall become the property of GPS. Shipping costs are to be borne by the purchasing party.

This express warranty is extended by GPS to the party purchasing the Product (“Buyer”) and is not assignable or transferable to any other party. This is the complete warranty for the Products, except as modified by separate agreement between GPS and Buyer.

GPS is not responsible under this warranty for ancillary equipment, whether or not manufactured by GPS, which is attached to or used in connection with the Product, nor for operation of the Product with any such with any such ancillary equipment.

Because each Product system is unique, GPS disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

This warranty applies within the fifty (50) United States and the District of Columbia.



WHAT THIS WARRANTY DOES NOT COVER:

Defects or damage resulting from use of the Product in other than its normal and customary manner, (b) Defects or damage from misuse, accident or neglect, (c) Defects or damage from improper testing, operation, maintenance, installation, alteration, modification or adjustment, (d) Product disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim, (e) Product which has had the serial number removed or made illegible.

HOW TO GET WARRANTY SERVICE:

To receive warranty service, call toll free +1-877-574-9292.



GENERAL PROVISIONS:

This warranty sets forth the full extent of GPS's responsibilities and liability regarding the Product, and repair, replacement, or refund of the purchase price, at GPS's option, is Buyer's exclusive remedy.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH ARE SPECIFICALLY EXCLUDED INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN NO EVENT SHALL GPS BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT.

PATENT AND SOFTWARE PROVISIONS:

GPS will defend at its own expense any suit brought against Buyer to the extent that it is based on a claim that the Product or parts infringes a United States patent, and GPS will pay those costs and damages finally awarded against Buyer in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following: (i) that GPS will be notified promptly in writing by Buyer of any notice of such claim; and (ii) that GPS will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and (iii) should the Product or parts become, or in GPS's opinion be likely to become, the subject of a claim infringement of a United States patent, that Buyer will permit GPS, at its option and expense, either to procure for Buyer the right to continue using the Product or parts or to replace or modify the same so that it becomes non-infringing or to grant Buyer a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by GPS.

GPS will have no liability with respect to any claim of patent infringement, which is based upon the combination of the Product or parts furnished by GPS, nor will GPS have any liability for the use of ancillary equipment or software not furnished by GPS, which is attached to or used in connection with the Product. The foregoing states the entire liability of GPS with respect to infringement of patents by the Product or any parts thereof.

Laws in the United States and other countries preserve for GPS certain exclusive rights for copyrighted GPS software such as the exclusive rights to reproduce in copies and distribute copies of such GPS software. GPS software may be copied into, used in and redistributed with only the Products associated with such GPS software. No other use, including without limitation disassembly, of such GPS software or exercise of exclusive rights in such GPS software is permitted. No license is granted by implication, estoppel or otherwise under the patent rights of GPS or any third party.