CATERPILLAR®

SEBU7464-01
March 2001

Operation and Maintenance Manual

UPS 250, UPS 300, UPS 500, UPS 600, UPS 750 and UPS 900 Uninterruptible Power Supply

CSE1-Up (Uninterruptible Power Supply)
CNM1-Up (Uninterruptible Power Supply)
CPM1-Up (Uninterruptible Power Supply)
CTX1-Up (Uninterruptible Power Supply)
CRY1-Up (Uninterruptible Power Supply)
CPZ1-Up (Uninterruptible Power Supply)

UPS 500 and the UPS 600 (N+1 Option)

The Multiple Module Unit (MMU) Cabinet contains the following components:

- Flywheel Energy Storage System
- Flywheel Converter and Utility Converter
- Filter Inductor and Line Inductor
- Input and Output Contactors
- Static Switch

The System Cabinet contains the following components:

- Bypass Circuit Breaker
- Static Switch (optional equipment)
- Isolation Switches (optional equipment)

The Input/Output Cabinet can be configured for either single input or for dual input. The Input/Output Cabinet contains the following components:

- Power Cable Connections (optional equipment)
- Maintenance Bypass Switch (optional equipment)
- Isolation Switch (optional equipment)
- Output Isolation Switch (optional equipment)

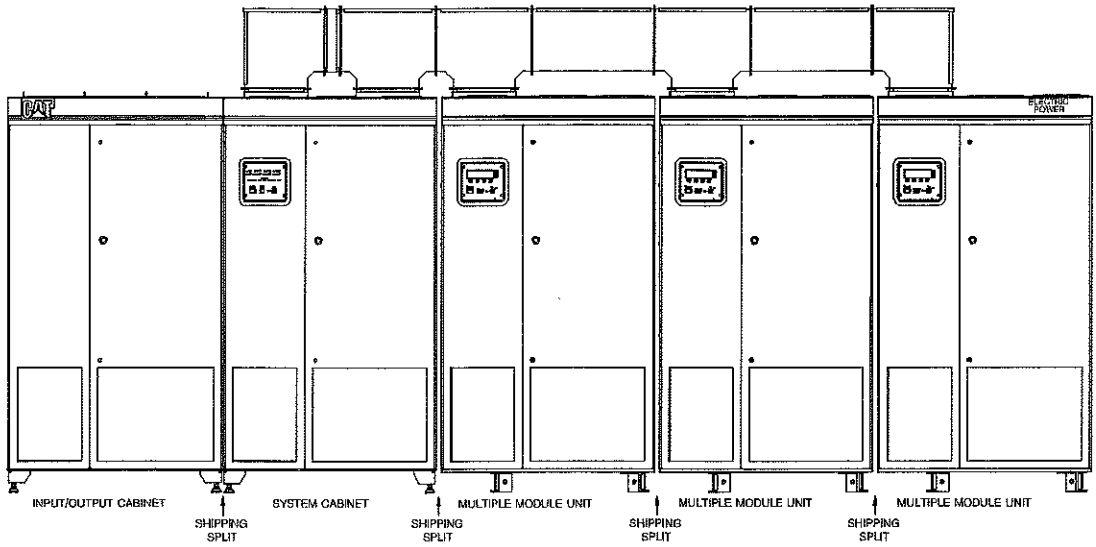

Illustration 16 g00757861

Front View Of The UPS 500 Or The UPS 600 (N+1 Option)

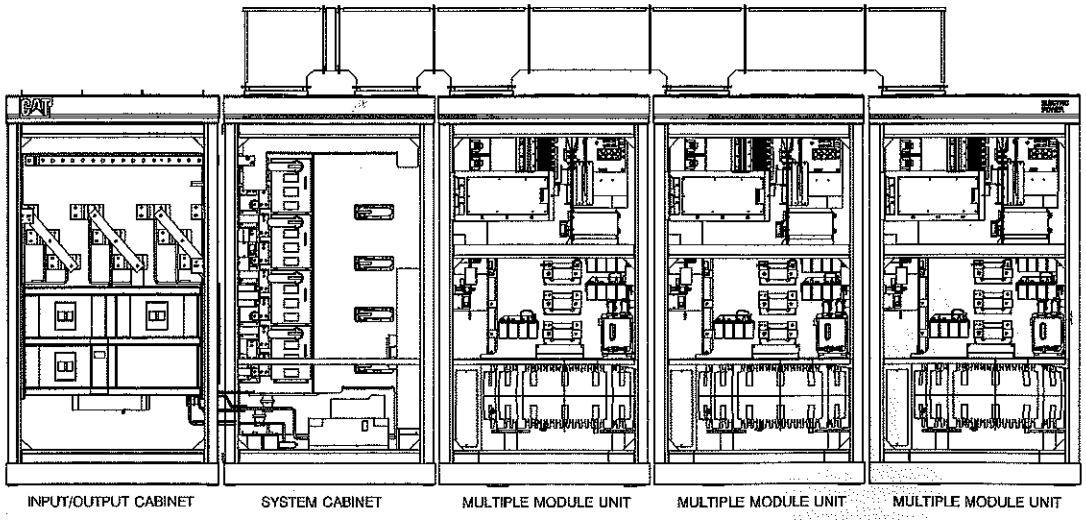

Illustration 17 g00757939

Front View Of The UPS 500 Or The UPS 600 (N+1 Option) Without The Sheet Metal Panels

UPS 750 and the UPS 900 (N+1 Option)

The Multiple Module Unit (MMU) Cabinet contains the following components:

- Flywheel Energy Storage System
- Flywheel Converter and Utility Converter
- Filter Inductor and Line Inductor
- Input and Output Contactors
- Static Switch

The System Cabinet contains the following components:

- Bypass Circuit Breaker
- Static Switch (optional equipment)
- Isolation Switches (optional equipment)

The Input/Output Cabinet can be configured for either single input or for dual input. The Input/Output Cabinet contains the following components:

- Power Cable Connections (optional equipment)
- Maintenance Bypass Switch (optional equipment)
- Isolation Switch (optional equipment)
- Output Isolation Switch (optional equipment)

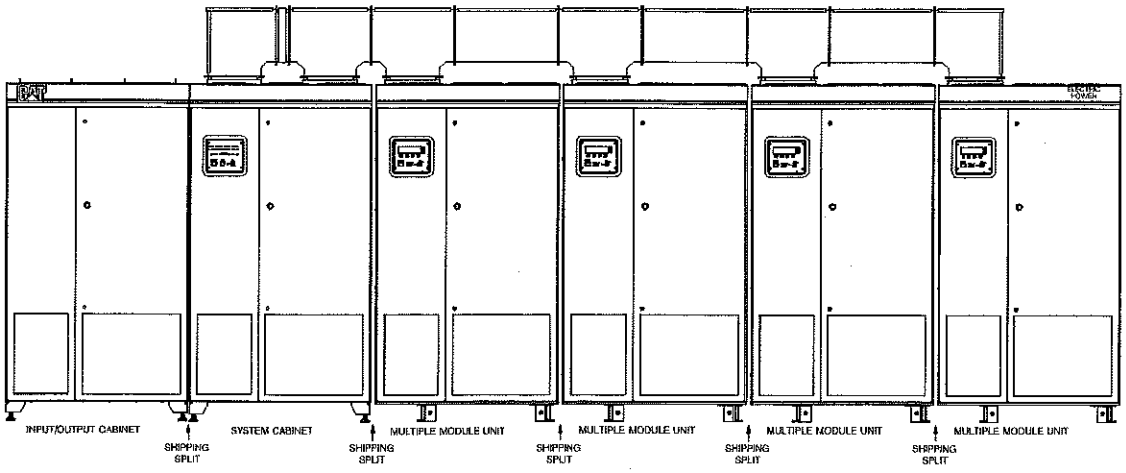

Illustration 18 g00757982

Front View Of The UPS 750 Or The UPS 900 (N+1 Option)

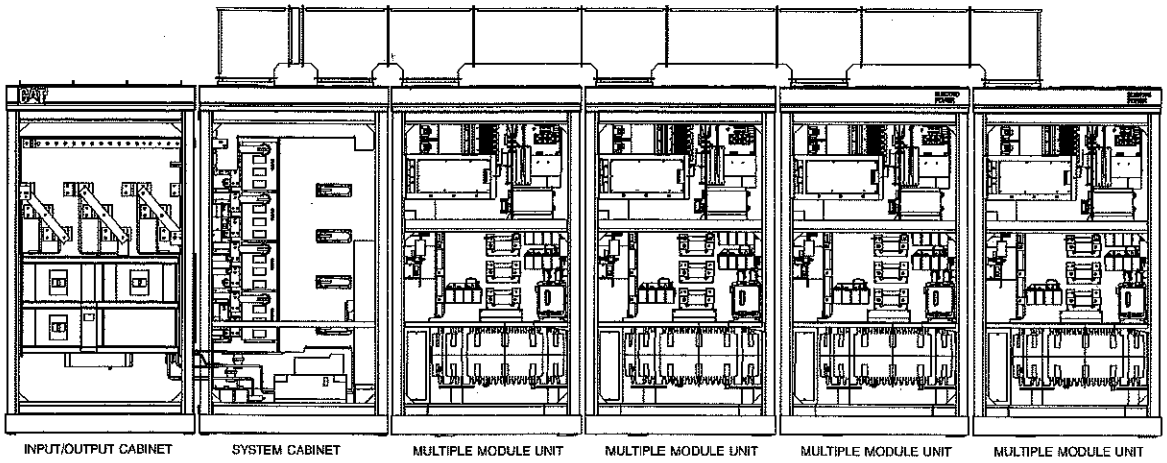

Illustration 19 g00757990

Front View Of The UPS 750 Or The UPS 900 (N+1 Option) Without The Sheet Metal Panels

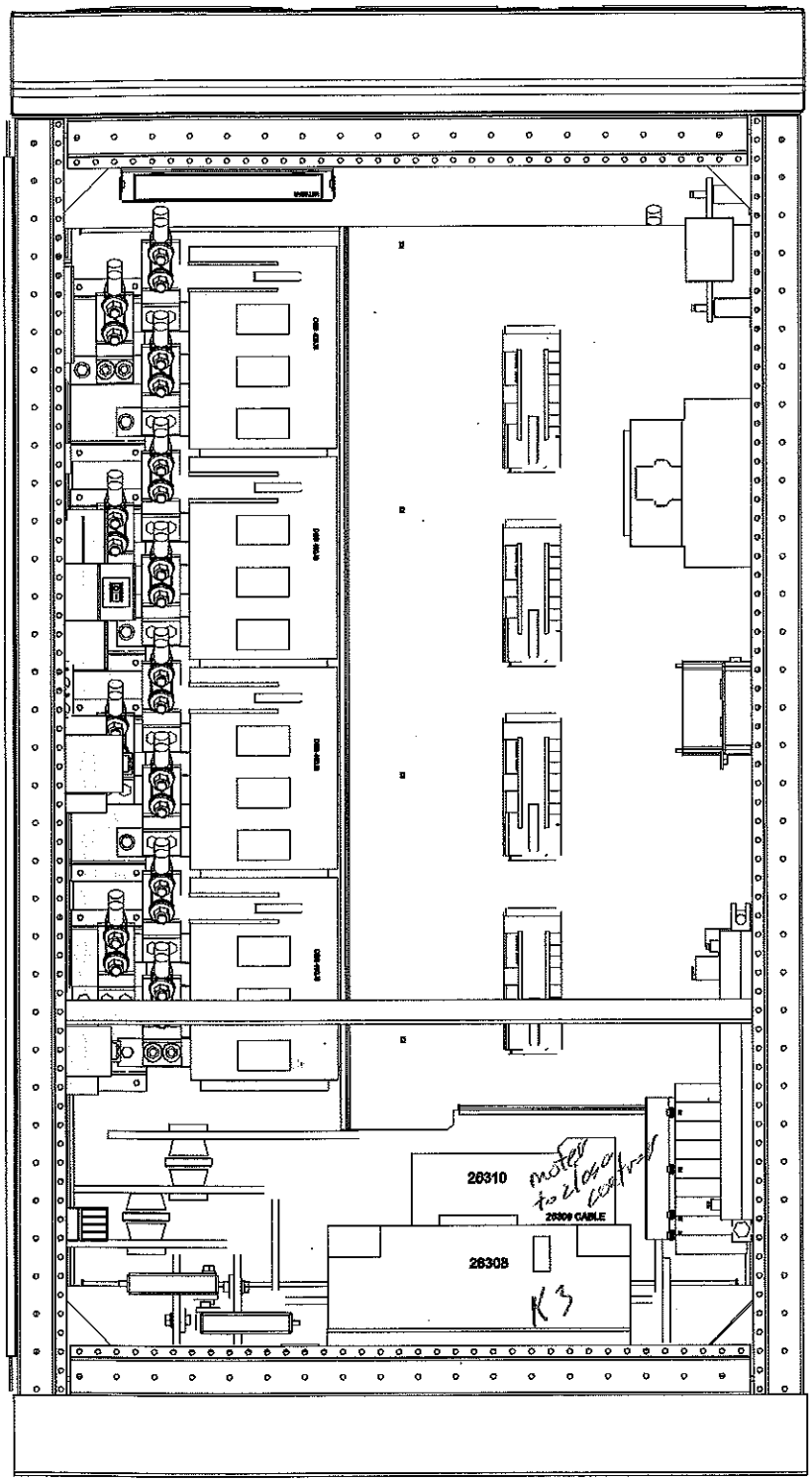

Illustration 22

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The Front View Of The System Cabinet And The Isolation Switches Without The Sheet Metal Panels

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System Description

SMCS Code: 4480

The Caterpillar Uninterruptible Power Supply (UPS) is a fully integrated line-interactive system that uses a flywheel to store mechanical energy in the form of a rotating mass. When utility power is interrupted, the UPS will convert the mechanical energy that is stored in the flywheel to electrical energy. This energy is supplied to the external load until one of the following conditions occur:

- The standby generator assumes the load
- The utility power is available again
- The flywheel runs out of energy

Once utility power returns, the system will transfer the load back to utility power without interruption.

The UPS can be used in a wide range of commercial power applications. The systems provide voltage regulation and protection from power outages. This is done in order to provide well regulated power to cover critical loads, sags, surges or outages.

The components of the MMS are housed in rugged free standing steel cabinets. The standard systems can consist of several cabinets depending on the model. Refer to Table 1.

Table 1

STANDARD SYSTEMS	
UPS 250/300 (expandable)	Multiple Module Unit Cabinet (1 each) System Cabinet (1 each) Input/Output Cabinet (1 each)
UPS 500/600	Multiple Module Unit Cabinet (2 each) System Cabinet (1 each) Input/Output Cabinet (1 each)
UPS 750/900	Multiple Module Unit Cabinet (3 each) System Cabinet (1 each) Input/Output Cabinet (1 each)
REDUNDANT SYSTEMS (N+1)	
UPS 250/300 (N+1)	Multiple Module Unit Cabinet (2 each) System Cabinet (1 each) Input/Output Cabinet (1 each)
UPS 500/600 (N+1)	Multiple Module Unit Cabinet (3 each) System Cabinet (1 each) Input/Output Cabinet (1 each)
UPS 750/900 (N+1)	Multiple Module Unit Cabinet (4 each) System Cabinet (1 each) Input/Output Cabinet (1 each)

The cabinets are transported as individual units. The units are delivered separately. The units are only assembled at the installation site. The MMU Cabinet weighs 2041 kg (4500 lb). The System Cabinet weighs 386 kg (850 lb). The Input/Output Cabinet weighs 590 kg (1300 lb).

UPS 750 and UPS 900 System Diagrams

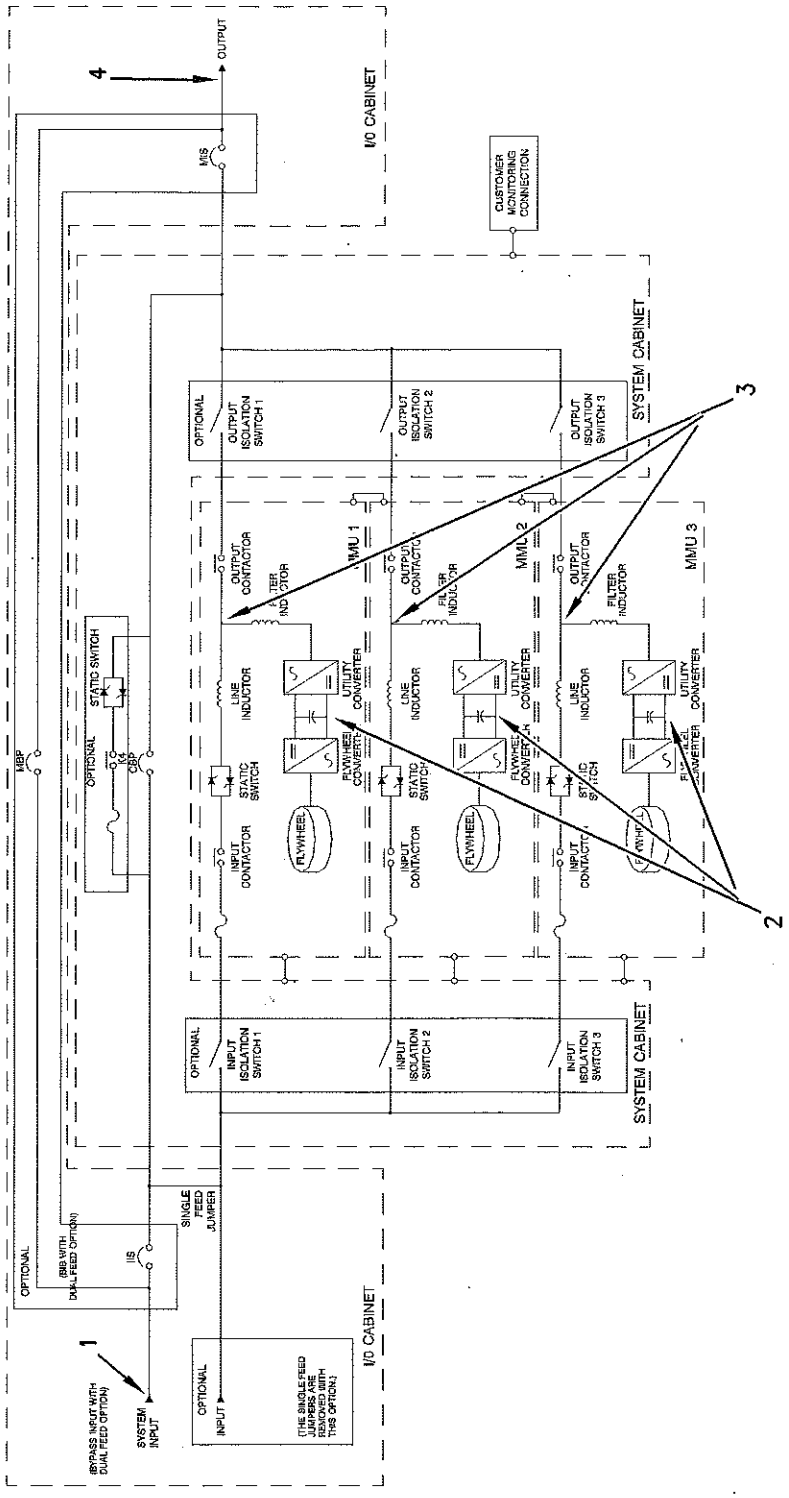

Illustration 31 g00759276

UPS 750/900 One Line Diagram

(1) Input Node
(2) DC bus
(3) Inverter Node
(4) Output Node

Illustrations 29 and 30 show a simplified one line diagrams of the UPS 500/600 and the UPS 500/600 (Redundant N+1) systems. The illustrations identify the main components in the systems and the location of the Input, Output and inverter nodes.

The nodes determine the state of the system. The input node and the output node are externally available. These nodes are used in order to attach the system to a power source and to the load. The inverter node is used internally by the system.

The DC bus is also identified in Illustrations 29 and 30. The DC bus is used as a power source for the field coil currents. The mode of the system determines if the bus is used as a power source for the flywheel or as a power source for the utility inverters.

A description of each component is in the following list:

Input Contactor – A mechanical contactor that is used to control the flow of electricity into each MMU.

Output Contactor – A mechanical contactor that is used to control the flow of electricity from each MMU.

Bypass Circuit Breaker – An electrically operated circuit breaker that is used to bypass the system.

Static Switch – The static switch is a semiconductor device (thyristors). The static switch is used to isolate each MMU from the utility grid when an out of tolerance condition occurs.

Flywheel Converter – The flywheel converter is a bidirectional semiconductor device that converts DC power into AC power to keep the flywheel spinning at full speed whenever utility is available. When utility is not available this converter rectifies AC power from the flywheel into DC power.

Utility Converter – The utility converter is a bidirectional semiconductor device that converts the DC bus voltage developed from the flywheel converter into AC power that is supplied to the inverter node. When utility is not available this converter rectifies DC power from the flywheel into AC power for the load.

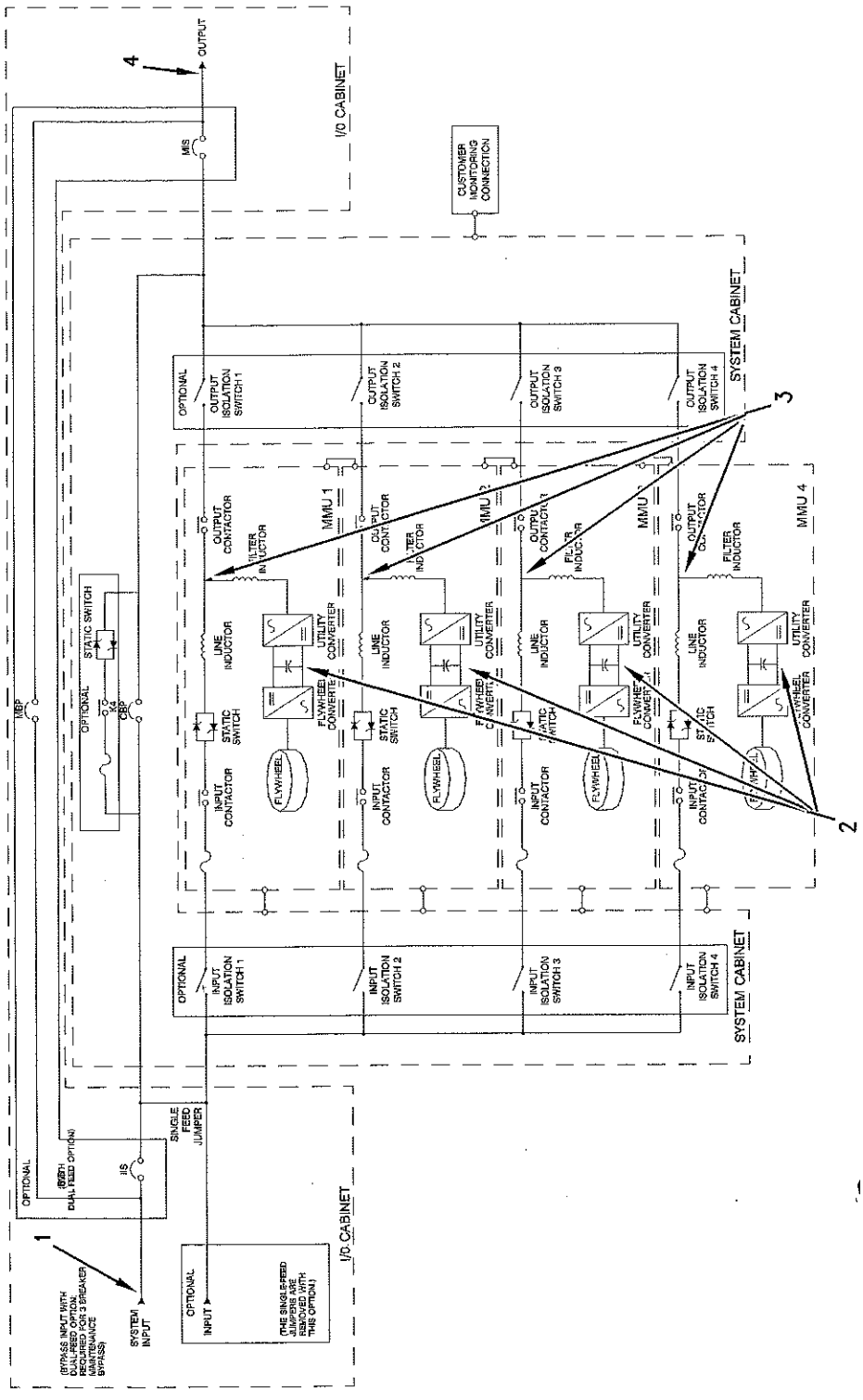

Illustration 32 g00759279

UPS 750/900 (Redundant N+1) One Line Diagram

(1) Input Node
(2) DC bus
(3) Inverter Node
(4) Output Node

Illustrations 31 and 32 show one line diagrams of the UPS 750/900 and the UPS 750/900 (Redundant N+1) system. The illustrations identify the main components in the system and the location of the Input, Output and Inverter nodes.

The nodes determine the state of the system. The input node and the output node are externally available. These nodes are used in order to attach the system to a power source and to the load. The inverter node is used internally by the system.

The DC bus is also identified in the illustrations. The DC bus is used as a power source for the field coil currents. The mode of the system determines if the bus is used as a power source for the flywheel or as a power source for the utility inverters.

A description of each component is in the following list:

Input Contactor – A mechanical contactor that is used to control the flow of electricity into each MMU.

Output Contactor – A mechanical contactor that is used to control the flow of electricity from each MMU.

Bypass Circuit Breaker – An electrically operated circuit breaker that is used to bypass the system.

Static Switch – The static switch is a semiconductor device (thyristors). The Static Switch is used to isolate each MMU from the utility grid when an out of tolerance condition occurs.

Flywheel Converter – The flywheel converter is a bidirectional semiconductor device that converts DC power into AC power to keep the flywheel spinning at full speed whenever utility is available. When utility is not available this converter rectifies AC power from the flywheel into DC power.

Utility Converter – The utility converter is a bidirectional semiconductor device that converts the DC bus voltage developed from the flywheel converter into AC power that is supplied to the inverter node. When utility is not available this converter rectifies DC power from the flywheel into AC power for the load.

Specifications

i01407894

Specifications

SMCS Code: 4480

Table 2

	60 Hertz Units			50/60 Hertz Units		
	UPS 300	**UPS 600**	**UPS 900**	**UPS 250**	**UPS 500**	**UPS 750**
Rating	300 kVA 240 kW	600 kVA 480 kW	900 kVA 720 kW	250 kVA 200 kW	500 kVA 400 kW	750 kVA 600 kW
Input Voltage	480 VAC	480 VAC	480 VAC	380 VAC 400 VAC 415 VAC	380 VAC 400 VAC 415 VAC	380 VAC 400 VAC 415 VAC
Output Voltage	480 VAC	480 VAC	480 VAC	380 VAC 400 VAC 415 VAC	380 VAC 400 VAC 415 VAC	380 VAC 400 VAC 415 VAC
AC Input						
Nominal Amperage	297 A	595 A	892 A	316 A 300 A 290 A	632 A 600 A 580 A	948 A 900 A 870 A
Maximum Amperage incl. recharge	440 A	880 A	1320 A	425 A 425 A 410 A	850 A 850 A 820 A	1275 A 1275 A 1230 A
AC Output						
Nominal Amperage	361 A	722 A	1084 A	380 A 361 A 348 A	760 A 722 A 694 A	1140 A 1083 A 1044 A
10 min max (Amperage)	452 A	900 A	1355 A	475 A 452 A 435 A	950 A 902 A 870 A	1425 A 1356 A 1305 A
Typical System Efficiency						
100% load	97%	97%	97%	96.4%	96.4%	96.4%
Physical Dimensions						
Height	1981.2 mm (78 inch)(1)	1981.2 mm (78 inch)(1)	1981.2 mm (78 inch)(1)	1977 mm (78 inches)(1)	1977 mm (78 inches)(1)	1977 mm (78 inches)(1)
Wireway Height	452 mm (17.8 inch)	452 mm (17.8 inch)	452 mm (17.8 inch)	452 mm (17.8 inch)	452 mm (17.8 inch)	452 mm (17.8 inch)
Depth	863.6 mm (34.0 inch)	863.6 mm (34.0 inch)	863.6 mm (34.0 inch)	863.6 mm (34.0 inch)	863.6 mm (34.0 inch)	863.6 mm (34.0 inch)
Width	3266 mm (127 inch)(2)	4318 mm (170 inch)(2)	5410 mm (213 inch)(2)	3266 mm (127 inch)(2)	4318 mm (170 inch)(2)	5410 mm (213 inch)(2)
Weight	3017 kg (6650 lb)	5059 kg (11150 lb)	7101 kg (15650 lb)	3280 kg (7230lb)	5322 kg (11730 lb)	7364 kg (16230 lb)

(continued)

(Table 2, contd)

	60 Hertz Units			50/60 Hertz Units		
	UPS 300	**UPS 600**	**UPS 900**	**UPS 250**	**UPS 500**	**UPS 750**
Cable Access	Top or Bottom	Top or Bottom	Top or Bottom	Top or Bottom	Top or Bottom	Top or Bottom
Heat Rejection Nominal/Maximum						
kW	7.5/15.3	14.8/30.6	22.3/45.9	7.5/14.1	14.9/28.3	22.3/45.9
BTU/Hr. x 1000	25.3/52.2	50.6/104.5	75.9/156.7	25.5/48.2	50.9/96.4	75.9/156.7
Specifications for Input						
Voltage	480 VAC, 3 phase plus ground (from grounded wye source)(4-wire optional)	480 VAC, 3 phase plus ground (from grounded wye source)(4-wire optional)	480 VAC, 3 phase plus ground (from grounded wye source)(4-wire optional)	380 VAC, 400 VAC, 415 VAC, 3 phase plus ground (from grounded wye source)	380 VAC, 400 VAC, 415 VAC, 3 phase plus neutral and ground (from grounded wye source)(3)	380 VAC, 400 VAC, 415 VAC, 3 phase plus neutral and ground (from grounded wye source)(3)
Voltage Range	+10%/–15% (programable)	+10%/–15% (programable)	+10%/–15% (programable)	+10%/–15% (4) (programable)	+10%/–15% (4) (programable)	+10%/–15% (4) (programable)
Power Factor	0.99 at rated load and nominal voltage	0.99 at rated load and nominal voltage	0.99 at rated load and nominal voltage	0.99 at rated load and nominal voltage	0.99 at rated load and nominal voltage	0.99 at rated load and nominal voltage
Harmonic Current Distortion						
Linear Load	3.0% max at 100% resistive load	3.0% max at 100% resistive load	3.0% max at 100% resistive load	3.0% max at 100% resistive load	3.0% max at 100% resistive load	3.0% max at 100% resistive load
Non-linear Load	<10% with a 100% non-linear load	<10% with a 100% non-linear load	<10% with a 100% non-linear load	<10% with a 100% non-linear load	<10% with a 100% non-linear load	<10% with a 100% non-linear load
Input Frequency	60 Hz ± 10% max (programable) (±3% default)	60 Hz ± 10% max (programable) (±3% default)	60 Hz ± 10% max (programable) (±3% default)	50 Hz ± 10% max (programable) (±3% default)(4)	50 Hz ± 10% max (programable) (±3% default)(4)	50 Hz ± 10% max (programable) (±3% default)(4)
Specifications for Surge	IEEE 587/ANSI C62.41	IEEE 587/ANSI C62.41	IEEE 587/ANSI C62.41	IEEE 587/ANSI C62.41	IEEE 587/ANSI C62.41	IEEE 587/ ANSI C62.41
Walk-In	programable from 1 second to 15 seconds	programable from 1 second to 15 seconds	programable from 1 second to 15 seconds	programable from 1 second to 15 seconds	programable from 1 second to 15 seconds	programable from 1 second to 15 seconds
Specifications for Output						
Voltage	480 VAC, 3 phase plus ground (4-wire with optional 4-wire input)	480 VAC, 3 phase plus ground (4-wire with optional 4-wire input)	480 VAC, 3 phase plus ground (4-wire with optional 4-wire input)	380 VAC, 400 VAC, 415 VAC, 3 phase plus neutral and ground	380 VAC, 400 VAC, 415 VAC, 3 phase plus neutral and ground	380 VAC, 400 VAC, 415 VAC, 3 phase plus neutral and ground

(continued)

(Table 2, contd)

	60 Hertz Units			50/60 Hertz Units		
	UPS 300	**UPS 600**	**UPS 900**	**UPS 250**	**UPS 500**	**UPS 750**
Overload Capability (Normal Operation without bypass)	1000% for 10 milliseconds	1000% for 10 milliseconds	1000% for 10 milliseconds	1000% for 10 milliseconds	1000% for 10 milliseconds	1000% for 10 milliseconds
	500% for 1 second	500% for 1 second	500% for 1 second	500% for 1 second	500% for 1 second	500% for 1 second
	200% for 30 seconds	200% for 30 seconds	200% for 30 seconds	200% for 30 seconds	200% for 30 seconds	200% for 30 seconds
	125% for 10 minutes	125% for 10 minutes	125% for 10 minutes	125% for 10 minutes	125% for 10 minutes	125% for 10 minutes
Voltage Regulation						
Steady-state	± 2 % of nominal for ± 10% input and balanced or unbalanced load	± 2 % of nominal for ± 10% input and balanced or unbalanced load	± 2 % of nominal for ± 10% input and balanced or unbalanced load	± 2 % of nominal for ± 10% input and balanced or unbalanced load	± 2 % of nominal for ± 10% input and balanced or unbalanced load	± 2 % of nominal for ± 10% input and balanced or unbalanced load
Flywheel Mode	± 2 % of nominal for steady-state balanced or unbalanced load	± 2 % of nominal for steady-state balanced or unbalanced load	± 2 % of nominal for steady-state balanced or unbalanced load	± 2 % of nominal for steady-state balanced or unbalanced load	± 2 % of nominal for steady-state balanced or unbalanced load	± 2 % of nominal for steady-state balanced or unbalanced load
Transient	± 5 % of nominal for 100% load (4 milliseconds recovery time)	± 5 % of nominal for 100% load (4 milliseconds recovery time)	± 5 % of nominal for 100% load (4 milliseconds recovery time)	± 5 % of nominal for 100% load (4 milliseconds recovery time)	± 5 % of nominal for 100% load (4 milliseconds recovery time)	± 5 % of nominal for 100% load (4 milliseconds recovery time)
Voltage Distortion	3% at Full Linear Load	3% at Full Linear Load	3% at Full Linear Load	3% at Full Linear Load	3% at Full Linear Load	3% at Full Linear Load
	5% at Full Non-Linear Load	5% at Full Non-Linear Load	5% at Full Non-Linear Load	5% at Full Non-Linear Load	5% at Full Non-Linear Load	5% at Full Non-Linear Load
Output Frequency	60 Hz ±10% (utility synchronized, normal operation) nominal ± 0.2% free running	60 Hz ±10% (utility synchronized, normal operation) nominal ± 0.2% free running	60 Hz ±10% (utility synchronized, normal operation) nominal ± 0.2% free running	50 Hz ±3%(utility synchronized, normal operation) nominal ± 0.2% free running	50 Hz ±3% (utility synchronized, normal operation) nominal ± 0.2% free running	50 Hz ±3% (utility synchronized, normal operation) nominal ± 0.2% free running
Slew Rate	Maximum of 1 Hz per second	Maximum of 1 Hz per second	Maximum of 1 Hz per second	Maximum of 1 Hz per second	Maximum of 1 Hz per second	Maximum of 1 Hz per second
Environmental Specifications						
Audible Noise	less than 70 dBA 1 m (3.28 ft)	less than 70 dBA 1 m (3.28 ft)	less than 70 dBA 1 m (3.28 ft)	less than 70 dBA 1 m (3.28 ft)	less than 70 dBA 1 m (3.28 ft)	less than 70 dBA 1 m (3.28 ft)
Operating Temperature	–20 °C (–4.0 °F) to 40 °C (104 °F)	–20 °C (–4.0 °F) to 40 °C (104 °F)	–20 °C (–4.0 °F) to 40 °C (104 °F)	–20 °C (–4.0 °F) to 40 °C (104 °F)	–20 °C (–4.0 °F) to 40 °C (104 °F)	–20 °C (–4.0 °F) to 40 °C (104 °F)
Storage Temperature	–25 °C (–13 °F) to 70 °C (158 °F)	–25 °C (–13 °F) to 70 °C (158 °F)	–25 °C (–13 °F) to 70 °C (158 °F)	–25 °C (–13 °F) to 70 °C (158 °F)	–25 °C (–13 °F) to 70 °C (158 °F)	–25 °C (–13 °F) to 70 °C (158 °F)

(continued)

(Table 2, contd)

	60 Hertz Units			50/60 Hertz Units		
	UPS 300	**UPS 600**	**UPS 900**	**UPS 250**	**UPS 500**	**UPS 750**
Humidity	5% to 95% (non-condensing)	5% to 95% (non-condensing)	5% to 95% (non-condensing)	5% to 95% (non-condensing)	5% to 95% (non-condensing)	5% to 95% (non-condensing)
Altitude	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.	Up to 914.4 m (3000 ft); (derate operating temperature by 1.2 C for every 305 m (1000 ft) above this limit.
Emissions and Immunity	FCC Class A, Subpart J of Part 15 and EN 50091-2	FCC Class A, Subpart J of Part 15 and EN 50091-2	FCC Class A, Subpart J of Part 15 and EN 50091-2	FCC Class A, Subpart J of Part 15 and EN 50091-2	FCC Class A, Subpart J of Part 15 and EN 50091-2	FCC Class A, Subpart J of Part 15 and EN 50091-2
Minimum Floor Load Capacity	325 pounds per square foot	325 pounds per square foot	325 pounds per square foot	325 pounds per square foot	325 pounds per square foot	325 pounds per square foot

(1) This dimension excludes the wireway.
(2) The N+1 option adds an additional 1092 mm (43 inch).
(3) Except ± 10% max at 380 VAC
(4) Also Available with 60 Hz nominal voltage

Table 3

480 Volt Systems	
% Load	**Ride-Through Time**
100%	13 seconds
75%	17 seconds
50%	25 seconds
25%	50 seconds
380/400/415 Volt Systems	
% Load	**Ride-Through Time**
100%	15 seconds
75%	20seconds
50%	25 seconds
25%	60 seconds

Table 4

All Models	
% Load	**Ride-Through Time**
100%	13 seconds
75%	17 seconds
50%	25 seconds
25%	50 seconds

Operation

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Starting and Stopping

SMCS Code: 4480

Placing the UPS System Online

The system is shipped from the factory with the auto-start bit set. When the system is powered up, the system will enter the state that is selected by the keyswitch. Place the keyswitch in the BYPASS position prior to starting.

Apply power to the system. This is done by closing the breaker upstream from the unit. Place the keyswitch in the On-line position. The system will enter the Bypassed-Auto Start state. The system will then begin to charge the flywheel. When the flywheel is at a rate of 4000 RPM, the system shifts to the On-line mode. The system is then operational.

If the system is stopped with the emergency power off switch, the emergency power off reset button (1) must be depressed. The button is located inside the left front door of the system. See Illustration 95.

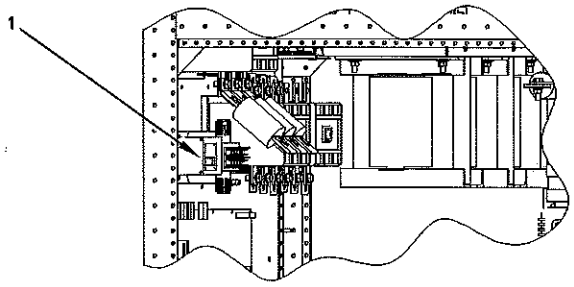


Illustration 95 g00682516

(1) Emergency Power Off Reset Button

Stopping in the Manual Bypass Mode

The system can be put into the bypass mode via the keyswitch. The keyswitch is located on the front panel. This will not stop the flywheel. The incoming power is connected directly to the load. When the system is in the bypass mode, the DC bus and the system's internal parts still have a residual charge.

Stopping for Maintenance

In order to stop the system for maintenance, the following components are required:

- Personal Computer
- UPS View Software
- Serial Cable

The PC must be connected to the system via the serial cable. When the system is stopped in this manner a technician may service the system.

Stopping for Maintenance Procedure

1. Connect the PC to the system. Connect the PC via the serial cable and the I/O Module.
2. Start UPS View on the PC.
3. Use UPS View and connect to the system.
4. Enter the maintenance password.
5. Press the "<CTRL><X>" keys in order to put the system into automatic discharge.

When the system is placed in the Auto-Discharge Mode, the bypass contactor will close and the output contactor will open. The load is not protected in this mode. The load is being powered by the utility via the bypass. Wait until the flywheel is at zero RPM before system maintenance. The system is still energized until the flywheel is stationary. Once the system changes from the Bypass-Auto Discharge Mode to the Bypass Mode the system is secured for maintenance. Voltage is still present in the cabinet.

Emergency Shutdown Modes

⚠ WARNING

Personal injury or death can result from high voltage.

When power generation equipment must be in operation to make tests and/or adjustments, high voltage and current are present.

Improper test equipment can fail and present a high voltage shock hazard to its user.

Make sure the testing equipment is designed for and correctly operated for high voltage and current tests being made.

Depress any one of the following buttons in order to activate an emergency shutdown:

- Emergency Module Off ("EMO")
- Emergency Power Off ("EPO")
- Emergency System Off ("ESO")
- Remote Emergency Power Off ("REPO")

Emergency Module Off ("EMO")

The "EMO" button is a "Blue" button which is located on the user interface panel of the MMU. When you depress the "EMO" button, the MMU that is connected to the system will be disconnected. The input contacts and the output contacts of that MMU will open.

The activation of the "EMO" button could send the system into the bypass mode, if the remaining MMU(s) can not support the load.

Emergency Power Off ("EPO")

The EPO button is a "Red" button which is located on the user interface panel of the system cabinet. The "EPO" button also comes with a remote emergency power off button.

Note: When the emergency power off switch is used, the entire system is secured. Power is not supplied to the load. However, voltage is still present on the input terminals.

Note: The critical load will lose power unless the customer has provided an external bypass.

Emergency System Off ("ESO")

The "ESO" button is optional. The "ESO" button is a "Yellow" button which is located on the user interface panel of the system cabinet. The activation of this button will put the system into the bypass mode. The optional "ESO" button also comes with a remote emergency power off button.

Note: When the emergency system off button is used, the input contactors and the output contactors in each MMU are open while the bypass contactor in the system cabinet is closed. Power is still supplied to the load. Voltage is still present on the input terminals.

Remote Emergency Power Off ("REPO")

The "REPO" button is optional. The "REPO" button will disconnect all MMU(s) in the system by opening the MMU(s) input and output contactors.

Note: When the remote emergency button is used, the entire system is secured by opening the following contactors: input contactors in each MMU, output contactors in each MMU, and bypass contactor in the system cabinet. Power is not supplied to the load. However, voltage is still present on the input terminals.

Emergency Power Off Reset Circuit Breaker

The "EPO" reset circuit breaker must be used after any Emergency Shutdown mode is activated. The "EPO" reset circuit breaker is located inside the left front door of the system cabinet. See Illustration 96.

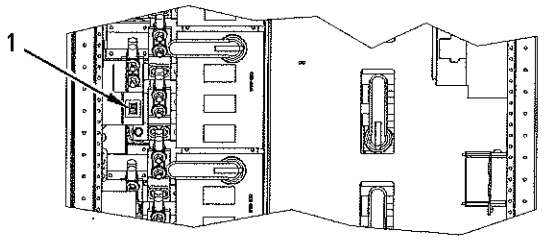


Illustration 96 g00784415

(1) Emergency Power Off Reset Circuit Breaker

i01453614

Modes Of Operation

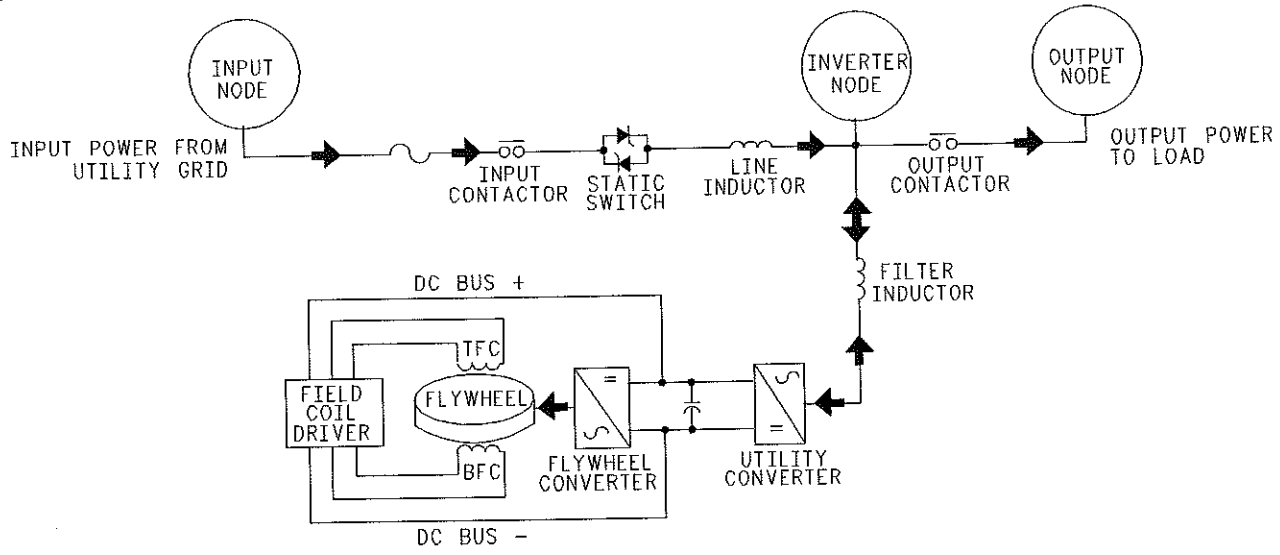
SMCS Code: 4480

Most of the operating modes have several states that occur in the mode. The mode and the state are displayed on the LCD display. The LCD display is located on the front panel.

The operating modes are listed below:

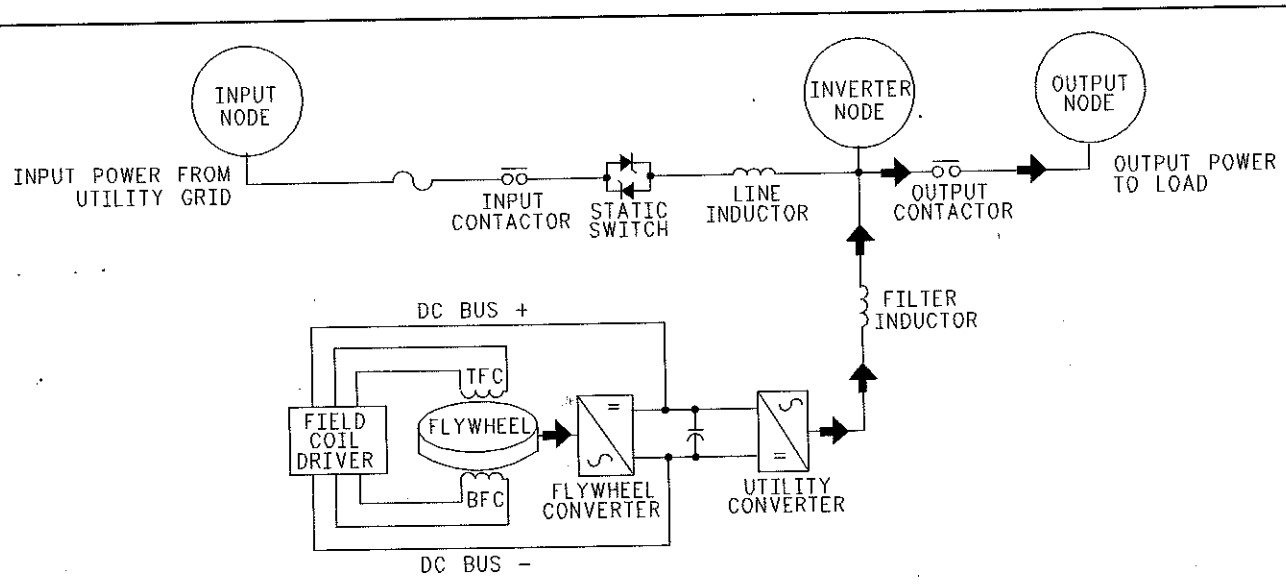
- Online Modes
- Bypass Modes
- Automatic Voltage Regulation (AVR) Mode
- Manual Mode
- Calibration Mode

Online Modes



g00784285

Illustration 97
Online Mode



g00784326

Illustration 98
Online Discharging Mode

Online – Online mode is the standard operating mode for the system. When the system is in this mode, the load is protected. The system is capable of discharging in order to support the load.

Online Charging – The system enters this state when the flywheel reaches 4000 RPM. The system is charging in this state. The system can sustain discharge in this state. When the speed of the flywheel is greater than 7700 RPM, the system enters the Online Standby state.

Online Standby – When the speed of the flywheel reaches 7700 RPM, the system is in the Online standby state. This is rated idle speed for the flywheel.

Online Discharging – The system is in this state when the unit is supplying power to the load. If there is a disruption in power, the system will change to this state.

Bypass Modes

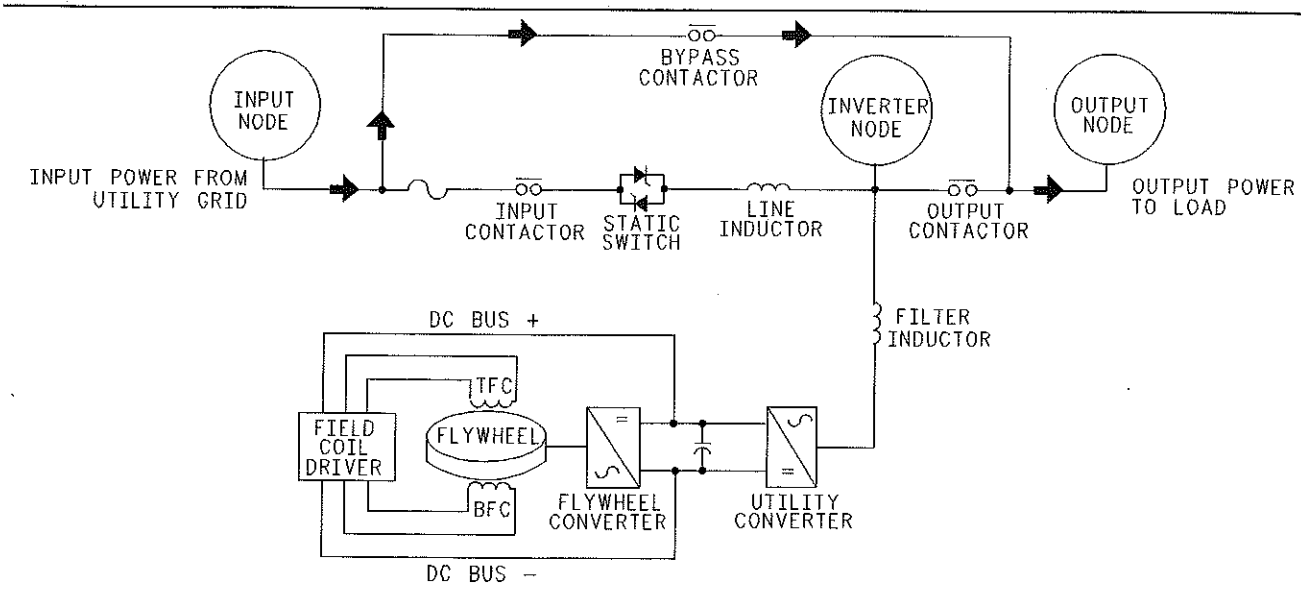


Illustration 99 g00784341

Bypass Mode

Bypass – Bypass mode directly connects the incoming utility to the system load. When the system is in the bypass mode, the load is not protected. The load can be affected by a disruption of incoming power.

The Bypass mode is entered by one of the following events:

- Start-up
- The Keyswitch (Manual)
- Failure to Recover From a Fault

Repeated errors that cause the system to oscillate between the bypass mode and Online mode can lock the system into the bypass mode. When the system is locked in the bypass mode, the user must change the mode of the system. Use the keyswitch in order to change the mode of the system.

Bypassed-Verify Signals – When the system is in this state, the system verifies that the correct system telemetry is present. This state is used when you are starting the system and the state is used during the recovery of errors.

Bypassed-Auto Start – This is the default state at start-up. The system cannot immediately protect the load after the system is started. During the normal operation, the system will enter Automatic Voltage Regulation ("AVR") mode.

Bypassed-Self Discharge – This state stops the flywheel electrically. This state is used in order to prepare the system to be moved. Also, this state is used in order to secure the system for maintenance. The Bypassed-Self Discharge mode can be entered once in a 24 hour time period.

Automatic Voltage Regulation ("AVR") Mode

The Automatic Voltage Regulation ("AVR") Mode can be entered by one of the following events:

- Start-up
- Flywheel Error

Automatic Voltage Regulation Auto Start – The system remains in the "AVR" Mode until the system is charged and until the system is able to sustain discharge. During the Automatic Voltage Regulation Auto Start state, the flywheel must achieve a rate of 45 RPM before changing to the Automatic Voltage Regulation Charging state.

Automatic Voltage Regulation Charging – The system enters this state when the system starts to charge the flywheel. When the speed of the flywheel is greater than 7700 RPM, the system enters the Online Stand-by state. Normally, the system enters the Online Charging state when the flywheel reaches 4000 RPM.

Automatic Voltage Regulation Verify Signals – When the system is in this state, the system verifies that the correct system telemetry is present. This state is used when you are starting the system and the state is used during the recovery of flywheels errors.

Manual Mode

The manual mode is intended to be used by service technicians. When the system is in the manual mode, a technician can conduct diagnostic tests of the subsystems. This mode is only accessible to qualified service personnel.

Calibration Mode

Calibration Mode is used in the factory during the initial calibration.

Calibration - Calibration Point – The system uses this state to calibrate a telemetery channel.

Calibration-Energizing – This state is used during sensor calibration. This state energizes the flywheel. The flywheel spins to several hundred RPM.

Calibration-Auto Adjusting – This state adjusts the commutation of the flywheel in order to maximize charging.

i01517619

Parallel Operation

SMCS Code: 4480

Load Sharing

In parallel operation, all inverter units automatically share load at all times. The output current of individual MMU(s) will be no more than ±5% unbalanced. The parallel load sharing function is programmed within each MMU. In (N+1) systems the redundant MMU only shares the reactive current.

Non-Redundant System

In a non-redundant system, all the MMU(s) making up the UPS will supply the full rated load. If MMU(s) malfunction, the load will transfer automatically to the bypass line without interruption.

Any MMU(s) can be taken off the critical load manually for maintenance without disturbing the critical load bus.

Redundant (N+1) Option

A redundant (N+1) system is sized with one more MMU than it is required to supply the full rated system load. In this configuration, the loss of one MMU will not cause the system to drop the critical load. The malfunction of one of the MMU(s) will cause that MMU to disconnect from the critical load. The remaining MMU(s) will continue to carry the load. After the MMU(s) has been repaired, the units can be reconnected to the critical load and resume redundant operation.

If more than one MMU is removed from the system and if the load exceeds the capacity of the MMU(s) remaining on-line, the load will automatically transfer to the bypass line without interruption.

Any redundant MMU(s) can be taken off the critical load manually for maintenance without disturbing the critical load bus. In this case, the isolation switches are used

Manual Load Transfers

A manual load transfer between the UPS output and the alternate bypass AC source can be initiated from the System Cabinet control panel. Manually initiated transfers are "make-before-break". These transfers utilize the UPS output and the system bypass circuit breakers.

Automatic Load Transfers

An automatic load transfer between the inverter outputs and the alternate bypass AC source is initiated if an overload condition is sustained for a time period in excess of the system output capability. An automatic load transfer may also be initiated due to a malfunction that would effect the output voltage. Transfers that are caused by overloads, initiate an automatic retransfer of the load back to the system only after the load has returned to a level within the rating of the UPS. The UPS system logic allows for up to three retransfers. The retransfers are adjustable within ten minute periods in order to prevent cyclical transfers which are caused by overloads. On the fourth transfer the system will lockout in bypass.

Momentary Overloads

The static bypass switch will connect the bypass AC source to the load and close the system bypass circuit breaker in one of the following cases:

- Load current inrush
- Branch load circuit fault is in excess of the system rating

The load transfer to bypass will be uninterrupted.

Selective Tripping

Each MMU has a self-diagnostic capability. If an MMU(s) failure does occur, the faulty MMU(s) will identify the internal failure. This MMU(s) will be subsequently removed from the critical bus. Selective tripping does not rely on information that is shared among MMU(s).

Communication Between MMU(s)

Communication between MMU(s) is provided by the system input/output board using Category 5, 4 pair UTP-24 AWG Wire (shielded).

Communication Outside the UPS System

One MMU serves as the processor for the serial communications link to the outside. The system cabinet has a parallel cabinet interface board with a rotary switch that allows you to select the MMU that will be used for external communications. External communications can be done via one of the following methods: RS-232/RS-485 port, ethernet, and modem.

Protection and Backfeed Prevention

The critical output bus is protected from the flow of excess current fuses. Each phase of the bypass circuit is protected by the bypass circuit breakers. Blown fuse monitors indicate when a blown fuse will prevent the static bypass switch path from being available for automatic transfers.

The static bypass switch will not backfeed UPS power to the bypass distribution system while the UPS system is operating on flywheel mode during a bypass source power outage. The static bypass switch is provided with redundant bypass power outage sensing circuits and disconnects. The backfeed prevention system operates even if two component failures exist simultaneously. If a shorted SCR is detected, the static bypass switch is isolated. An alarm message will be annunciated at the System Cabinet control panel. The load shall remain on conditioned and protected power after detection of a shorted SCR and after isolation of the static bypass switch.

i01511303

System Bypass Operation

SMCS Code: 4480

The bypass circuit isolates the inverter outputs from the critical bus for one of the following reasons:

- When maintenance is required
- When the UPS can not maintain voltage to the load due to sustained overload or malfunction

The bypass circuit also provides a path for power directly from an alternate AC (bypass) source. The UPS control system constantly monitors the availability of the system bypass circuit to perform a transfer.

The system bypass circuit consists of the following components:

- Static bypass switch
- UPS output circuit breaker
- System bypass circuit breaker
- Static bypass switch

The UPS output circuit breaker isolates the UPS module outputs. System bypass circuit breaker works in parallel with the static bypass switch. The static bypass switch is a solid-state device that can instantaneously connect the alternate AC source to the load.

i01517623

User Interface for Multiple Module Unit

SMCS Code: 4480

The User interface Panel provides the primary means for the operator to interface with UPS. The User Interface Panel provides the operator with information that is vital to the safe operation of the equipment. The User interface Panel allows the operator to start and stop the UPS, change the operating parameters and mode of operation and displays system errors and telemetry data. Information such as voltage input and output, power factor, output current, flywheel speed and the number of discharges executed are displayed for operator viewing on the Liquid Crystal Display (LCD).

Display Contrast Adjustment

Once power is applied to the system, the LCD should be active. If "Menu" is not displayed in the LCD or there is no text visible, use the up and down arrow keys (1) on the LCD to increase or decrease the contrast of the screen.

Once the screen is adjusted for the best viewing, the adjustment is done. The current setting is saved in non-volatile memory. The non-volatile memory will remember the setting through the power cycles

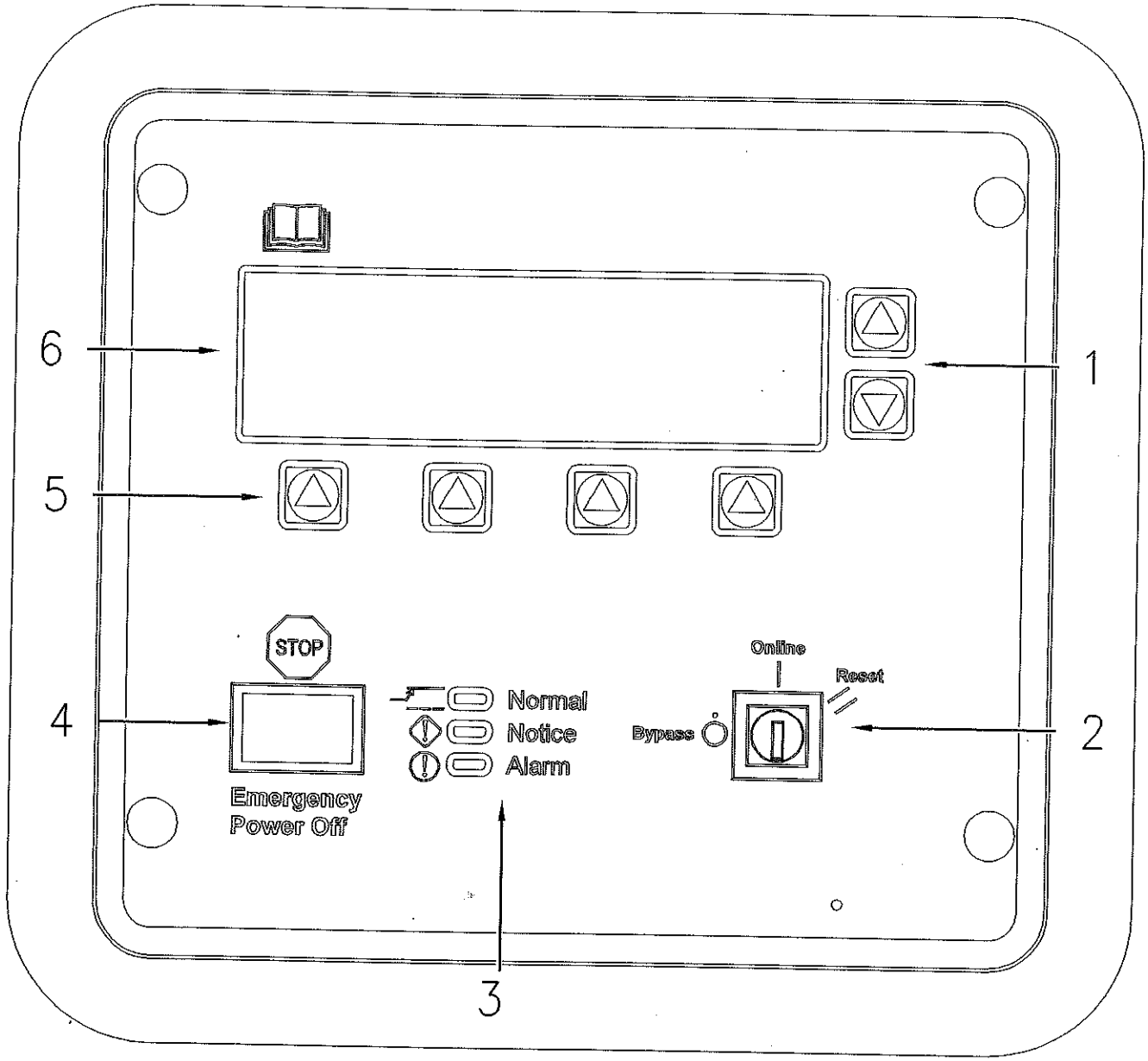


Illustration 100 g00760076

User Interface Multiple Module Unit Display

(1) Arrow Keys
(2) Keyswitch
(3) Status Indicators
(4) Emergency Module Off Button
(5) Soft Keys
(6) Liquid Crystal Display

(1) Arrow Keys – The keypad has two arrow keys located at the right of the LCD. The keys are used in conjunction with the LCD display and the function of the keys change depending on upon information displayed to the left of the key. The arrow keys have the following functions:

- In the default display mode, the arrow keys adjust the contrast of the LCD.
- When a menu is accessed the keys act as an "UP" key and a "DOWN" key.

(2) Keyswitch – Used to control the operation of the MMU. The keyswitch is used under the following conditions:

- Reset or restart the system after an error, or any Emergency Shutdown mode is activated.
- Lock the MMU into the Bypass or Online position when the key is turned to that position and is removed from the keyswitch.

(3) Status Indicators – The status indicators alert the operator to the status of the MMU. It also alerts the operator of notice and alarm messages. The status of the MMU and any messages will be displayed in the LCD.

- **Normal -** During normal operation this lamp will remain illuminated. When the MMU is the bypass mode or the system is discharging this lamp will flash. This is a green lamp.
- **Notice -** When there is a "Notice Message" this lamp will illuminate and an audible alarm will activate. This is a yellow lamp.
- **Alarm -** When there is an "Alarm Message" this lamp will illuminate and an audible alarm will activate. This is a red lamp.

(4) Emergency Module Off Button ("EMO") – Used to place the MMU in the shutdown mode. This button is blue and is labelled "EMO".

⚠ WARNING

When the emergency power off switch is used, high voltage still remains in the system.

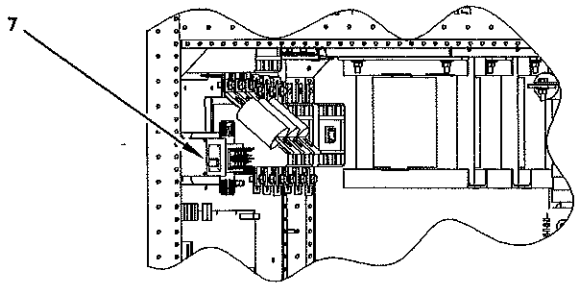


Illustration 101 g00760189

(7) Emergency Power Off Reset Circuit Breaker MMU Cabinet

In order to restart the system after using the "EMO" button, you must depress the EPO reset circuit breaker and turn the keyswitch to the Reset position. The circuit breaker is located inside the left front door of the system. See illustration 101.

Note: When the "EMO" button is depressed, the system will turn off the appropriate MMU and could cause the system to go to bypass mode if the remaining MMU(s) do not have sufficient capacity to support load.

(5) Soft keys – The keypad has four soft keys located at the bottom of the LCD. The keys are used in conjunction with the LCD display and the function of the key is indicated by text that is displayed above the key. The typical functions are "HOME", "SELECT", "BACK", and "MENU".

The "HOME" key takes you to the default display. The "SELECT" key enables the user to select a menu item. The menu item must first be highlighted on the screen. The "BACK" key enables the user to back up to the previous menu. The "MENU" key enables the user to return to the top menu.

(6) Liquid Crystal Display (LCD) – The LCD displays the following information:

Status Messages – These messages indicate normal system events are displayed during normal operation. The messages are printed to the "Message log". The log may be accessed from the front display. The log may also be accessed in UPS View

Notice Messages – System errors that are not critical will generate Notice Messages. When this condition exists, the system will not shift to the Bypass mode. However, a service technician may be required to fix the problem.

A Notice Message will cause the "NOTICE" lamp to illuminate. The system will also emit an audible alarm. These messages are printed to the "Notice Log" and to the "Message log". The log may be accessed from the front display. The log may also be accessed in UPS View. Examples of the events that generate notice messages are in the following list:

- Fan Failures
- DC Capacitor Bank Fuse Failure (1 only)
- Abnormal Thermal Conditions

Alarm Messages – System errors that are critical will generate Alarm Messages. Alarm Messages indicate that the system is in the Bypass mode and action is required. An Alarm Message will cause the "ALARM" LED to illuminate. The system will also emit an audible alarm. These messages are printed to the "Alarm Log" and to the "Message log". The log may also be accessed in UPS View. Examples of the events that generate alarm messages are in the following list:

- Multiple Fuse Failures
- Extreme Thermal Conditions

Telemetry Data – The type of telemetry data that the LCD will display is listed below:

- Three-Phase Input Voltage
- Three-Phase Output Voltage
- Output Current
- kVA
- Kilowatts
- Power Factor
- The Speed of the Flywheel
- The Number of executed discharges
- The Percentage of the Total Energy That is Available
- The Protected Load as a Percentage of the Rating of the System.

Time and Date Adjustment

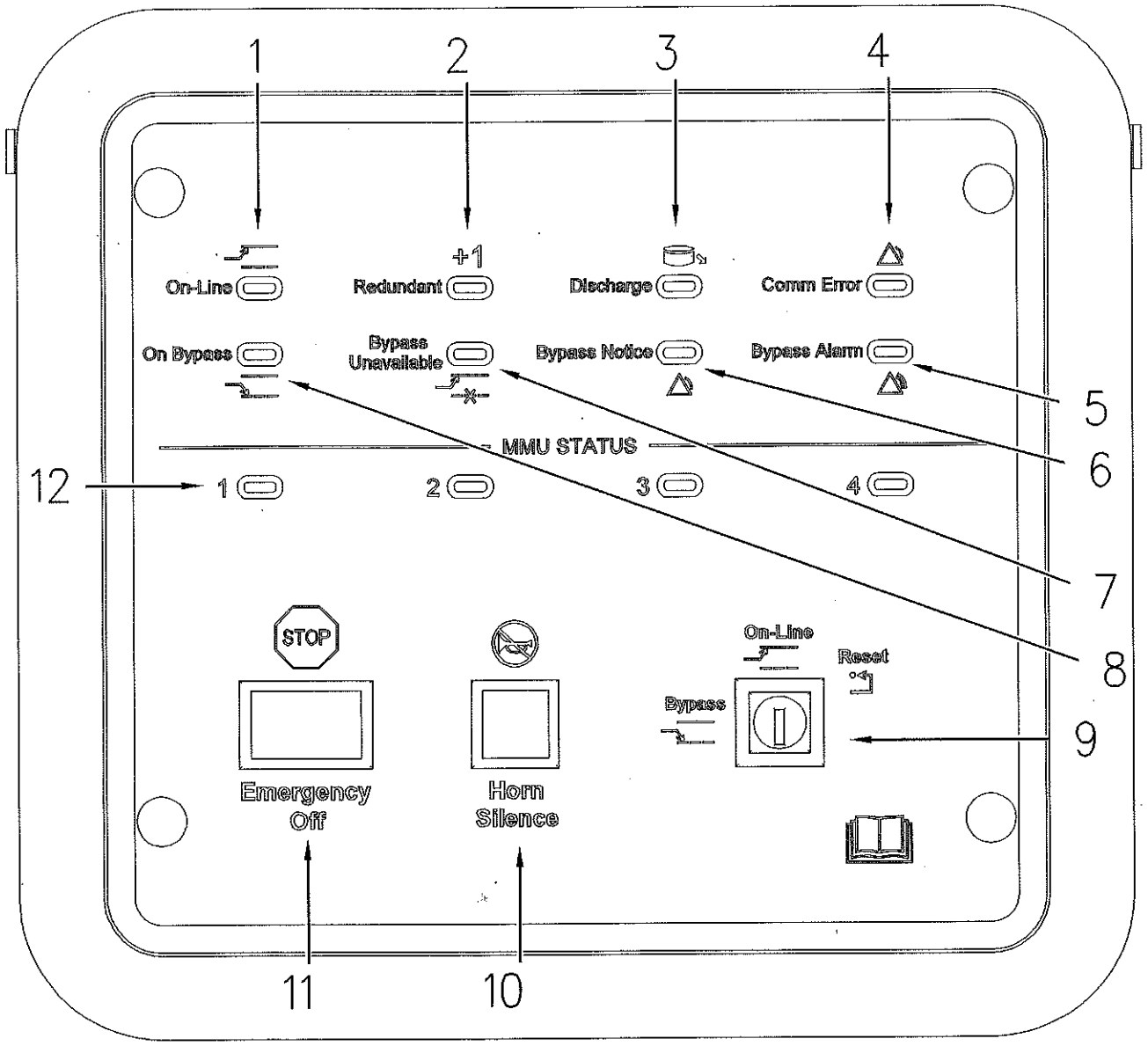
1. If "Menu" is not displayed in the LCD, press the soft key (5) under "Home".
2. .Press the soft key (5) under "Menu".
3. Use the up and the down arrow keys (1) in order to highlight the "Settings" menu in the LCD.
4. When the "Settings" menu is selected, press the soft key (5) under "Select".
5. Use the up and down arrow keys (1) in order to highlight the "Time and Date" menu.
6. When this menu is highlighted, press the soft key "5" under "Select".
7. Use the up and down arrow keys "1" in order to increase or decrease the selected setting.
8. Press the soft key (5) under "Tab" in order to bypass any setting that does not need adjusting.
9. If you need to restore the original setting, press the soft key (5) under "Restore" before you press the soft key (5) under "Accept".
10. Once the proper time and the proper date is adjusted, press the soft key (5) under "Accept".

i01517627

User Interface for System Cabinet

SMCS Code: 4480

The User Interface Panel for the system cabinet allows the operator to monitor the operation of the UPS system. The User Interface Panel provides the operator with the status of the MMU(s) and the system through the use of indicator lamps. The User Interface Panel also allows the operator to initiate system functions such as stopping the system in an emergency, placing the system in to bypass and resetting the system.



g00760169

Illustration 102

User Interface System Cabinet Display

(1) On-line Indicator
(2) Redundant Indicator
(3) Discharge Indicator
(4) "Comm Error" Indicator
(5) Bypass Alarm Indicator
(6) Bypass Notice Indicator
(7) Bypass Unavailable Indicator
(8) On Bypass Indicator
(9) Keyswitch
(10) Horn Silence
(11) Emergency Power Off Button
(12) Status Indicator MMU(s)

The User Interface System Cabinet controls and monitors the operation of all Multiple Module Units.

(1) On-line Indicator – This lamp illuminates to indicate that the system is Online. This lamp is green.

(2) "Redundant" Indicator – This lamp illuminates to indicate that there are more MMU(s) supporting the load then are required. This lamp is green.

(3) "Discharge" Indicator – This lamp illuminates when the system is discharging. This lamp is yellow.

(4) "Comm Error" Indicator – This lamp illuminates when the communication between the system cabinet and any MMU(s) fails. This lamp is yellow.

(5) "Bypass Alarm" Indicator – This lamp is red. It illuminates when a fault in the bypass circuitry has been detected.

(6) "Bypass Notice" Indicator – This lamp illuminates when there is an abnormal condition of the system cabinet that will not prevent a make before break transfer to bypass. For example, this may be a failure of the static transfer switch. This lamp is yellow.

(7) "Bypass Unavailable Indicator" – This lamp illuminates to indicate that the bypass source is not available. This lamp is yellow.

(8) "On Bypass" Indicator – Illuminates when either the bypass static switch is on or the main bypass contactor is closed. This lamp is yellow.

(9) Keyswitch – Used to control the operation of the system. The keyswitch is used under the following conditions:

- Reset or restart the system after an error, or any Emergency Shutdown mode is activated.
- Lock the MMU into the "Bypass"or On-line position when the key is turned to that position and is removed from the keyswitch.

This function only prevents manual operator intervention. The system will still switch to bypass automatically if necessary.

The keyswitch has the following positions:

- The "Bypass" position is used to transfer the system to bypass. This position is used during certain maintenance procedures. This position offers no protection from problems with the incoming power.
- The On-line position is the normal operating mode of the system. This position provides protection for problems with incoming power.
- The "Reset" position is used to reset the system after any shutdown condition. The "Reset" position is a spring loaded position that returns the key to the On-line position when released.

(10) Horn Silence – Silences an audible signal on the system and MMU cabinets when a notice, alarm or shutdown condition occurs. This button also serves as a test button for the lamps. The test function for the lamps is inhibited during alarm conditions.

(11) Emergency Power Off Button – Used to place the system in the shutdown mode. This button is red and is labelled "EPO".

Emergency System Off Button (Optional) – Used to place the system in the bypass mode. This button is yellow and is labelled "ESO".

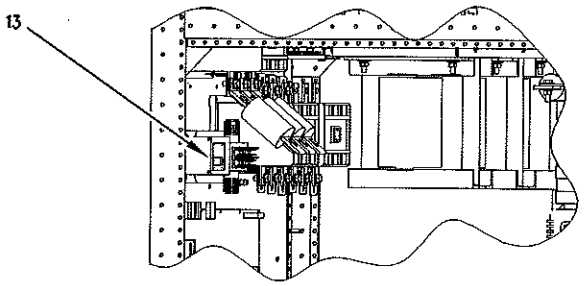


Illustration 103 g00760252

(13) Emergency Power Off Reset Circuit Breaker

In order to restart the system after using the "EPO/ESO" button you must:

1. Reset the system cabinet emergency power off circuit breaker. The circuit breaker is located inside the left front door of the system cabinet. See Illustration 103.
2. Reset all MMU(s) emergency power off circuit breakers.
3. Turn the system cabinet keyswitch to the "Reset" position.

(12) Status Indicators MMU(s) – The indicators can be green, yellow or red depending on the state of the MMU that is being monitored. Green indicates that the MMU(s) is in normal operation. Yellow indicates a notice condition has occurred. Red indicates that an alarm condition has occurred.

Monitoring Software

i01404209

Software Installation

SMCS Code: 4480

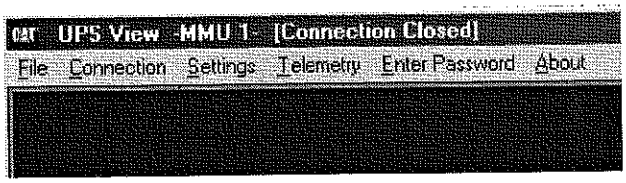
Setup

1. Insert the "Install" disk into the PC.
2. Run "Setup.exe".
3. Click on the "NEXT" button.
4. Read the license agreement.
5. Click on the "YES" button.
6. Identify the desired location for the files.
7. Click on the "FINISH" button.

i01517633

Getting Started

SMCS Code: 4480



g00787443

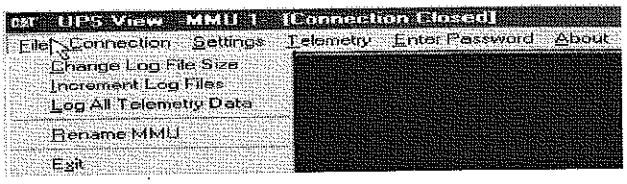
Illustration 104
UPS View Default Display

The display has five pull-down menus:

- "File" Menu
- "Connection" Menu
- "Settings" Menu
- "Enter Password" Menu
- "About" Menu

Once a connection is made to the UPS, a sixth menu will appear. This menu is called "Telemetry" menu. All six menus provide the user with a variety of functions.

"File" Menu



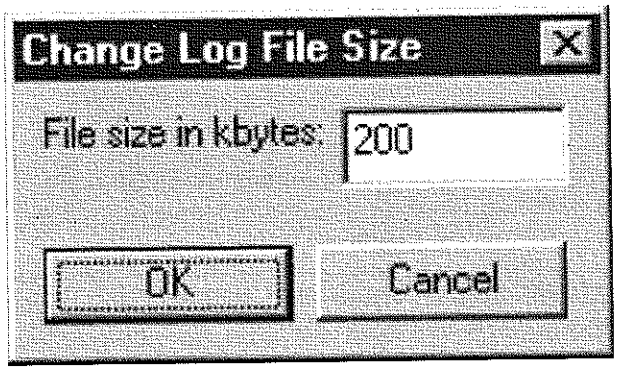
g00787482

Illustration 105

The "File" menu has five options:

- "Change Log File Size"
- "Increment Log Files"
- "Log All Telemetry Data"
- "Rename MMU"
- "Exit"

"Change Log File Size"



g00674315

Illustration 106

This option allows the user to define the maximum size of the file in kilobytes.

"Increment Log Files"

This option allows the user to manually save the log to a disk.

"Log All Telemetry Data"

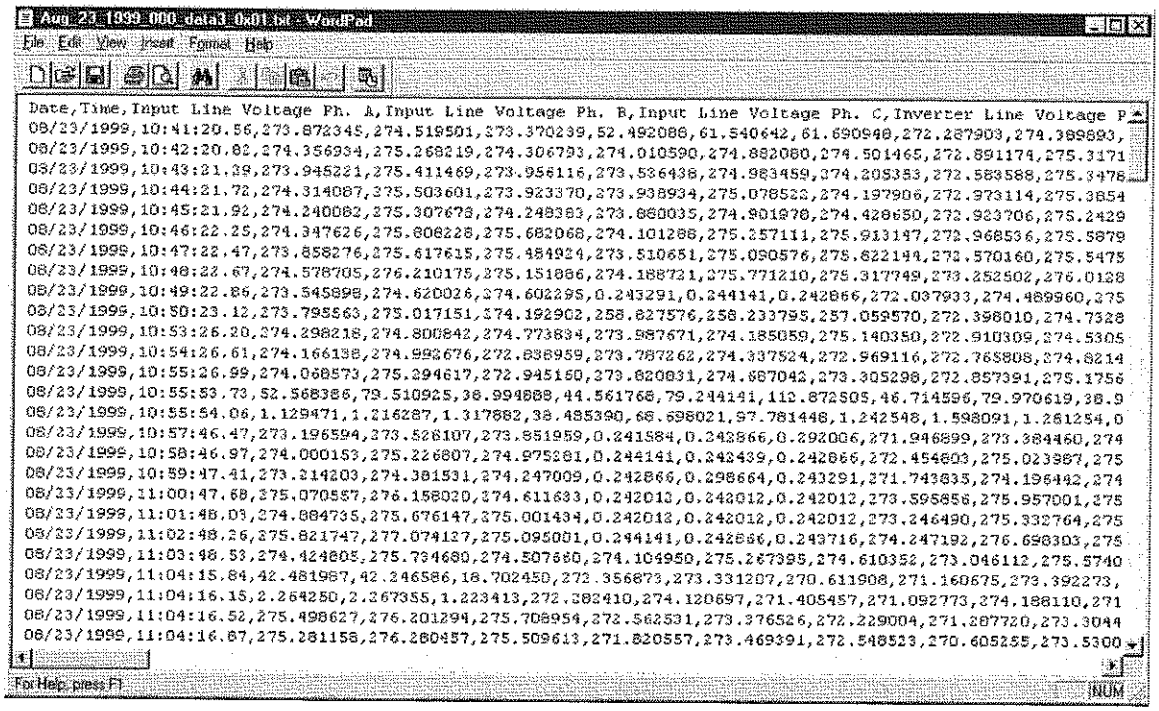


Illustration 107 g00648521

Log Files

This function forces all of the telemetry data to be saved to a disk.

Note: This option should be used sparingly. UPS View receives large quantities of data. You do not need to store all of the data. The system will automatically send the required data to UPS View. This data will be logged to a disk.

Note: The files are not deleted automatically. The operator must delete the files.

Log Files

The files are stored in a separate "Log" folder. The folder is inside of the "UPS View" folder. Telemetry data lines are continuously stored in the files. The files can be opened for manipulation. Software can be used to manipulate the files.

"Mar_24_1999_000_text_0x01.txt" is an example of the name of a file.

"Mar_24_1999" refers to the date. "000" is the number of the file. When a new file is opened, a new number is assigned. The number resets each day. The text indicates the type of file. The file could be text or the file could be data. "0x01" is the telemetry identification number.

"Rename MMU"

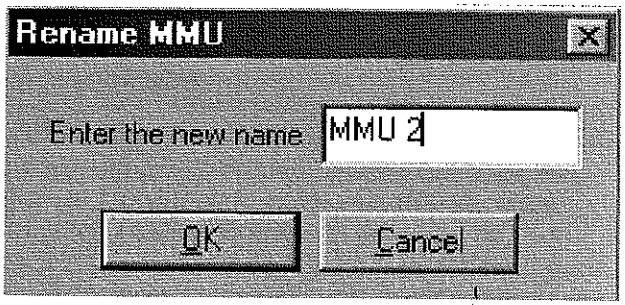


Illustration 108 g00787486

This option allows the user to change the name of the MMU.

"Exit"

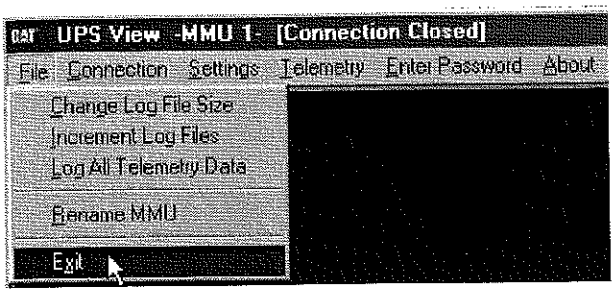


Illustration 109 g00787487

This will close the program.

"Connection" Menu

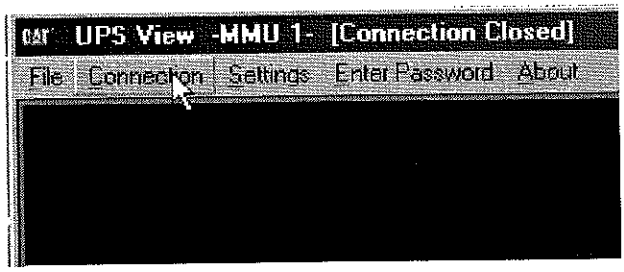


Illustration 110 g00787492

The "Connect" option enables communication between the "UPS View Client" and the UPS. Once you have selected the "Connection" drop down menu, you will have two options: "Connect" and "Disconnect".

"Connect"

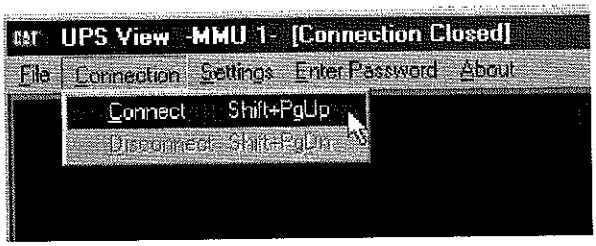


Illustration 111 g00787495

Select the "Connect" option to initiate communication.

"Disconnect"

The "Disconnect" option disables communication between the "UPS View Client" and the UPS. The TCP/IP and UDP/IP sockets between the Client and the UPS are closed. When the "Disconnect" option is selected, the exchange of data is stopped. This is done in order to analyze the information.

Note: All new telemetry data is lost while the UPS is disconnected from the Client. Notices, alarms, and error messages may occur while the Client is disconnected. All these messages are stored in the UPS memory.

"Settings" Menu

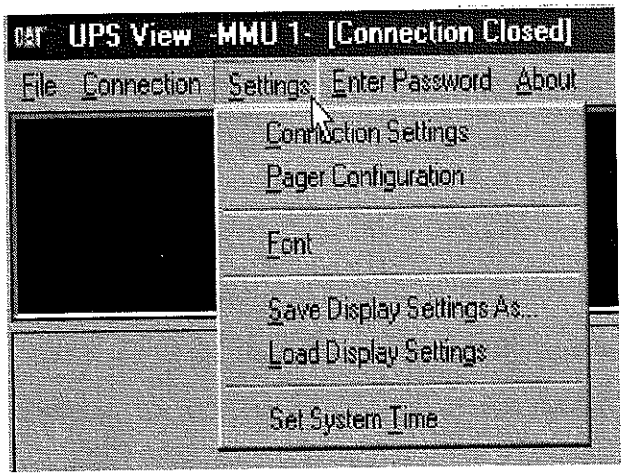


Illustration 112 g00787497

The "Settings" menu offers the following drop-down menus.

"Connection Settings"

Direct Connection (serial)

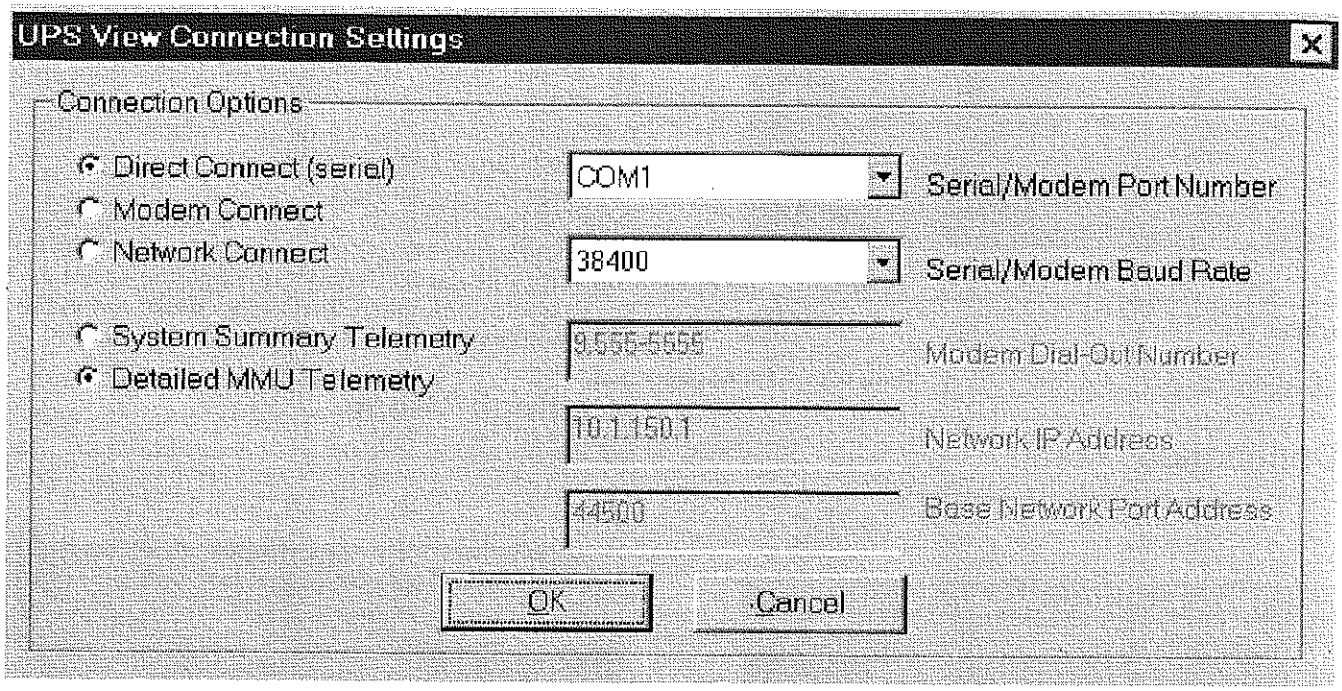


Illustration 113 g00787527

1. Select "Settings/Connection Settings".
2. Select "Direct Connect (serial)".
3. Select the "Serial/Modem port number" from the drop down list.
4. Select the "Serial/Modem baud rate" from the drop down list.
5. Click on the "OK" button.

Modem Connection

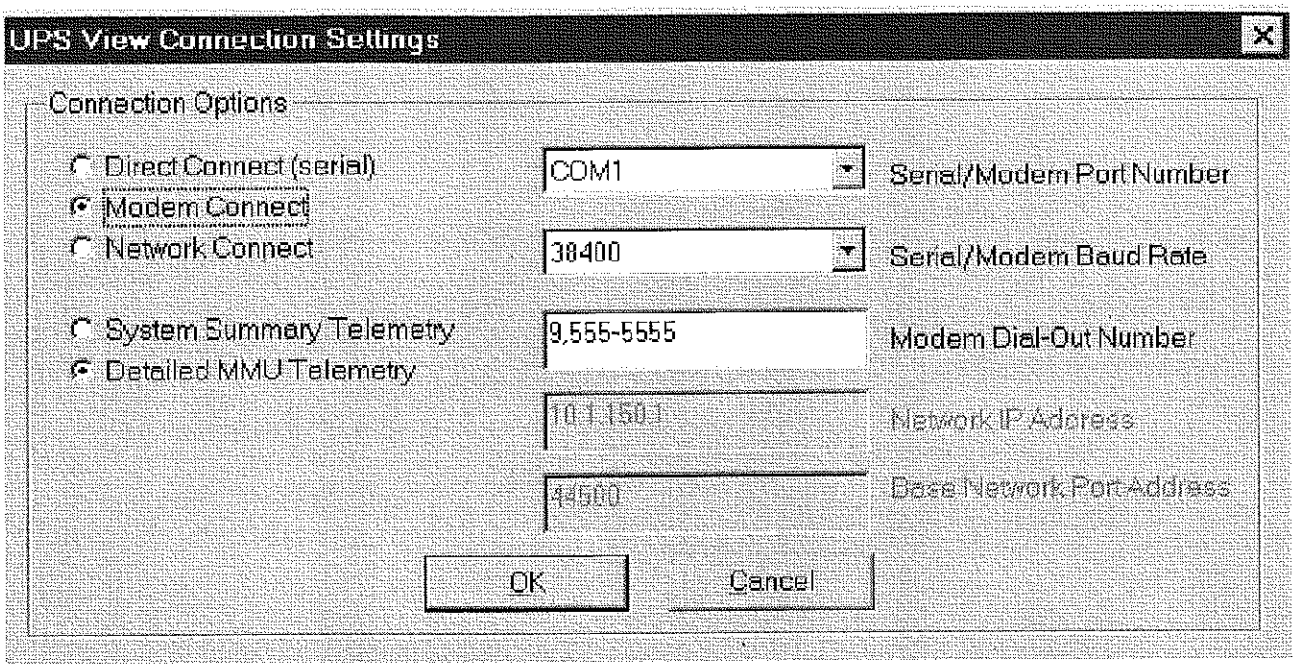


Illustration 114 g00787605

1. Select "Settings/Connection Settings".
2. Select "Modem Connect".
3. Select the "Serial/Modem port number" from the drop down list.
4. Select the "Serial/Modem baud rate" from the drop down list.
5. Input the "Modem dial-out number". The "Modem dial-out number" is the number of the telephone line that is connected to the UPS.
6. Click on the "OK" button.
7. Go to the "Connect" drop down menu and select "Connect". You should start to receive data through the connection.

Network Connection

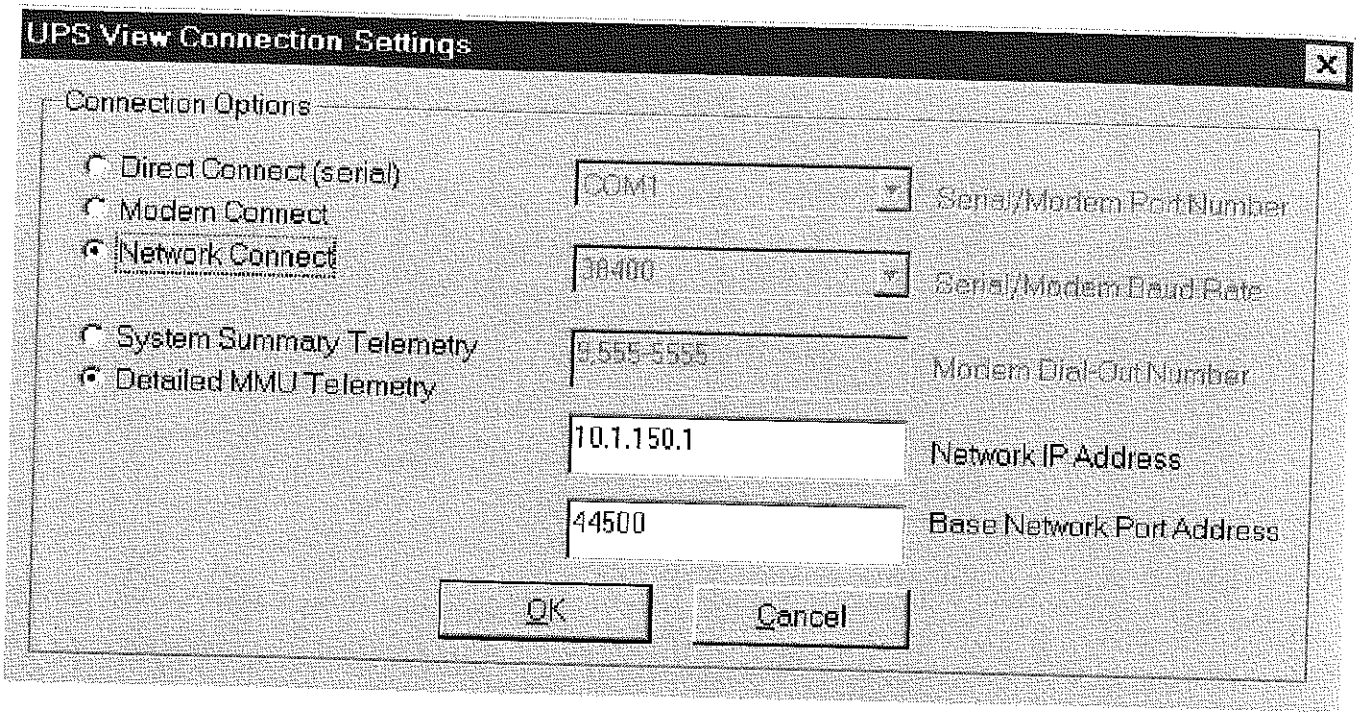


Illustration 115 g00787606

1. Select "Settings/Connection Settings".
2. Select "Network Connect".
3. Input the "Network IP address".
4. Input the "Base Network Port Address". Your System Administrator can assist you with the Network IP and the Base Network Port addresses.
5. Click on the "OK" button.

E-mail Configuration

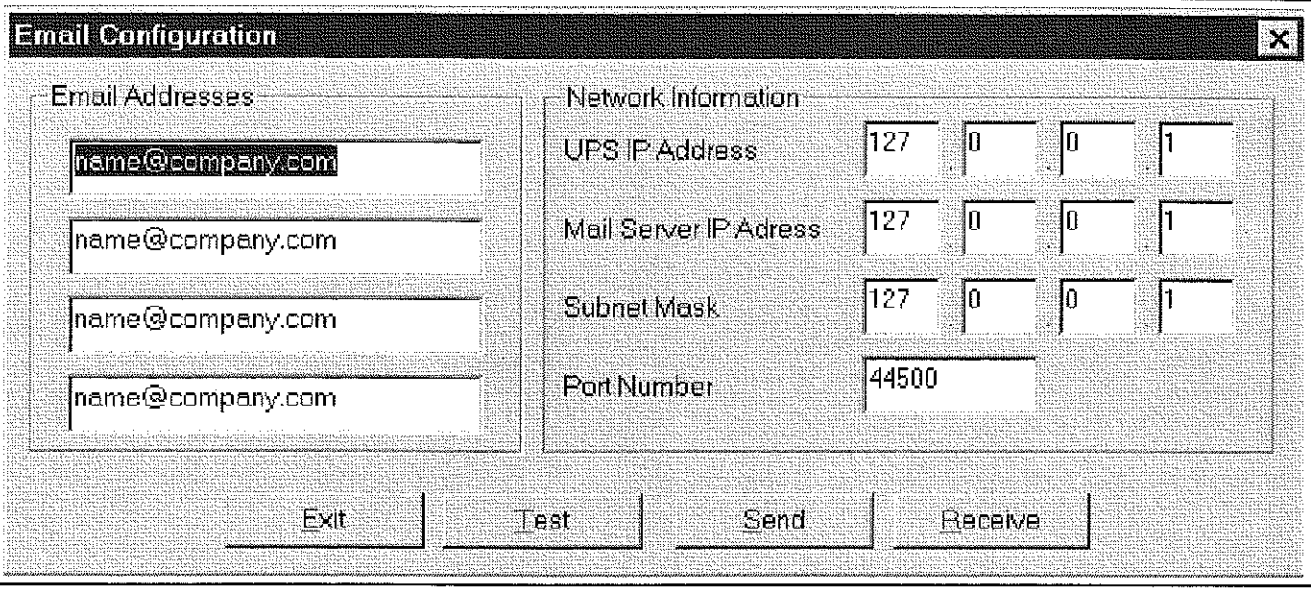


Illustration 116 g00787608

This option allows the end user to view, but not change the Network and E-mail configuration of the UPS.

1. Select "Settings/Remote Notification Settings".
2. Select "Email Configuration".
3. Input the "Email Addresses".

Note: The system can accept up to four Mail addresses. These options may change.

4. Input the "UPS IP Address" number.
5. Input the "Mail Server IP Address" number.
6. Input the "Subnet Mask" number.
7. Input the "Port Number".
8. Click on the "Send" button to store the information into flash memory.
9. Click on the "Receive" button to view the current settings stored in flash memory.
10. Click on the "Test" button. This will send out a test mail to the Mail addresses to ensure that the settings are correct.

Note: The UPS may need to be reset in order for this information to take affect. Press "Control R" then press "Y" to reset the UPS.

11. Click on the "Exit" button to close out the window.

Maintenance Section

i01519846

Maintenance Interval Schedule

SMCS Code: 4480

When Required

Every 3 Months

Every Year

Every 2 Years

i01404216

Air Filter - Replace

SMCS Code: 1051-510

Change the filter after ninety days of operation. If the environment dictates, the filter should be changed more often. Guidelines for the replacement of the filter are in the following list:

- There is an excessive buildup of dust.
- The filter is deflecting excessively due to blockage of the air flow.
- The system temperatures are steadily increasing.

i01404258

Bearing - Replace

SMCS Code: 7551-510

Bearings in the system have grease for life. Bearings do not require maintenance.

The bearings should be replaced periodically. The recommended interval is estimated at 2 and 1/2 years. The bearings are contained in removable cartridges. The cartridges are replaced at the same time as the bearings. The cartridges must be accurately positioned for proper operation. Only trained personnel may perform the replacement.

i01404469

Flywheel - Clean

SMCS Code: 1156-070

⚠ WARNING

Risk of electric shock or energy hazard. Parts inside this UPS are energized by the flywheel even when the AC power is disconnected.

The accumulation of dust on the surface of the flywheel can reduce the transfer of heat. The routine replacement of air filters should minimize buildup of dust on these surfaces. Refer to Maintenance Section, "Air Filter - Replace".

If the fins show heavy deposits of dust, the system should be de-energized. The deposits should be wiped off with a clean damp rag.

When you change the air filter, check for the accumulation of dust.

i01404570

Oil - Change

SMCS Code: 4287-510

Drain the Oil

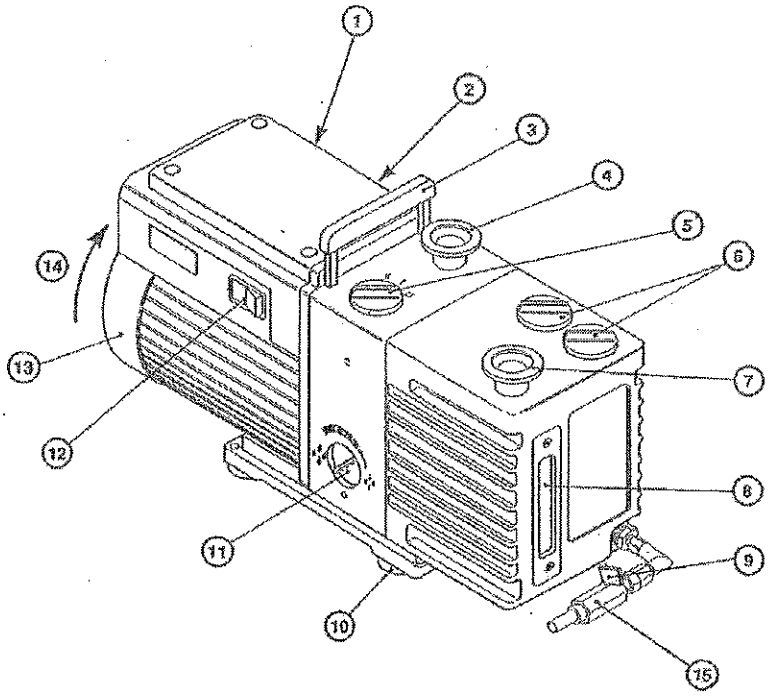


Illustration 139 g00666131

(1) Electrical Inlet Connector
(2) Voltage Indicator
(3) Lifting Handle
(4) Vacuum Intake Port
(5) Gas Ballast Control
(6) Oil Filler Plug
(7) Exhaust Port
(8) Oil Level Sight Glass
(9) Oil Drain Valve
(10) Rubber Feet
(11) Mode Selector
(12) Power Switch
(13) Fan Cover
(14) Direction of Rotation
(15) Drain Valve Assembly

⚠ WARNING

Risk of electric shock or energy hazard. Parts inside this UPS are energized by the flywheel even when the AC power is disconnected.

⚠ WARNING

Do not use pliers or other mechanical means other than fingers to adjust the vacuum pump mode selector switch. Failure to observe this note may result in damage to the pump and the inability of the system to reach the required operating pressure.

NOTICE

After operating the system for any period of time, the vacuum pump oil reservoir should be drained and refilled with new oil. If storage is anticipated or if vacuum pump shutdown is anticipated for more than 30 days, the vacuum pump oil reservoir should be drained and refilled with new oil. The pump should be allowed to come to operating temperature prior to draining the oil.

Pump service is not required when the pump is left running while the system is shut down. In this case, the time required to restart the system will be minimized.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

1. If the system has been shutdown and the pump is cool, run the pump for approximately ten minutes prior to changing the oil. This will decrease viscosity of the oil and the oil will drain easier.

2. Place the system in the Bypass Mode.

3. Shut down the vacuum pump by moving switch (12) to the OFF position.

⚠ WARNING

The drain oil is hot and can cause burns. Operating temperature of the oil is typically 60 °C (140 °F) or higher.

Avoid skin contact with the oil.

4. Drain the oil from the system into a suitable container for storage or disposal.

Note: A tube that has a 9.4 mm (0.37 inch) inner diameter may be used in order to direct the flow of the oil.

5. Open gas ballast (5). Turn dial (5) to the II position.

6. Remove one of the oil filler plugs (6).

7. Open oil drain valve (9) until the oil drains freely.

8. Drain the old oil.

Note: Allow sufficient time for the oil and any possible contamination to drain completely.

Add New Oil

190-8487 Vacuum Pump Oil is available from your Caterpillar Dealer.

1. Close oil drain valve (9).

2. Slowly add the new oil through oil filler hole (6). Add oil until the oil is at the level/fill line on sight glass (8).

3. Replace oil filler plug (6).

4. Run the pump for approximately ten minutes. This will circulate the new oil.

5. Close gas ballast (5). Turn dial (5) to the O position.

6. Return the keyswitch to the Online position.

i01404575

Oil Level - Check

SMCS Code: 4287-535

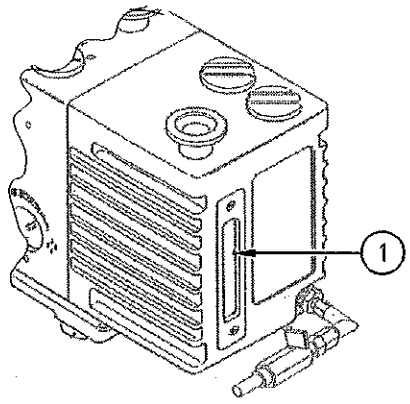


Illustration 140 g00666183

(1) Sight Glass

Observe the oil through the sight glass.

An oil change may not be required under the following conditions:

- The oil is even with the level/fill line.
- The oil does not show any signs of contamination.

An oil level that is higher than the level/fill line may indicate condensation of vapor. This situation requires the oil to be changed.

A dark colored oil indicates that the oil has been contaminated. This situation requires the oil to be changed.

A low level indicates that oil should be added to the pump. 190-8487 Vacuum Pump Oil is available from your Caterpillar Dealer.

i01404581

Sight Gauge - Clean

SMCS Code: 7479-070

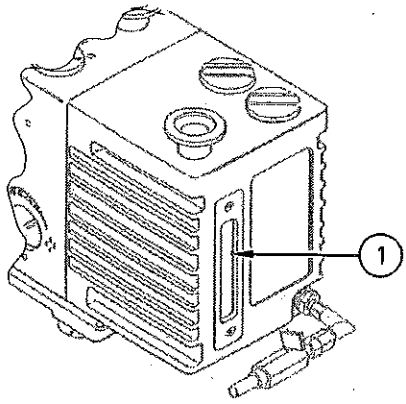


Illustration 141 g00666183

(1) Sight Glass

When you clean the sight glass, use a clean cloth that is free of lint. Carefully wipe the sight glass. Periodic cleaning of the sight glass will facilitate the observation of the condition of the oil.